THE IMPACT OF ASSESSMENT ON THE CONSTRUCTIVE ALIGNMENT OF A MODERN VETERINARY CURRICULUM

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Abstract

Constructive alignment (CA) describes an approach to education where teaching, learning and assessment are aligned to allow the learner to achieve the intended learning outcomes (ILOs) of the course. Assessment has a strong influence on learning and therefore the potential to have either a positive or negative impact on CA. The aim of the research in this thesis is to explore the effects of assessment on CA.

The context for the research is the final year of study within the School of Veterinary Medicine and Science (SVMS), at the University of Nottingham. Five mixed methods studies were conducted utilising questionnaires, semi-structured interviews and focus groups. In study one the ILOs of the course were defined and subsequently used in study two as a framework for an alumni survey to determine how well prepared graduates feel for clinical practice. Studies three and four investigated the impact of assessments on learning behaviour, namely multiple-choice questions (MCQ), directly observed procedural skills (DOPS) and the script concordance test (SCT). Finally in study five the influence of the transition to practice on learning behaviour during final year was explored.

Graduates felt well prepared by the SVMS curriculum for a career in practice with respect to all ILOs. However, assessments were not rated so highly when considered alone. DOPS and to some extent the SCT are considered to be authentic assessment formats and encourage a deep approach to learning. The MCQ in this context results in surface learning strategies being adopted. The imminent transition to practice has a

positive effect on learning behaviour, however this conflicts with the preparation required for final year examinations.

Elements of the assessment strategy that have a positive and negative impact on CA are identified and discussed. Changes to the curriculum are proposed to enhance CA and ease the transition to practice.

For Mum and Dad

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Finally I would like to say a massive thanks to my family, Mal, Steph and Jack who have all been supportive and at times extremely tolerant of me during this PhD.

"For every evaluative action there is an equal (or greater)

(and sometimes opposite) educational reaction"

Lambert Schuwirth, the "law" of educational cause and effect

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Abbreviations:

CA constructive alignment

CR clinical reasoning

DOPS directly observed procedural skill

ILO intended learning outcome

MCQ multiple-choice question

OA outcomes assessment

OBE outcomes based education

SLO student learning outcome

SVMS School of veterinary medicine and science

WPBA workplace based assessment

WPBL workplace based learning

Chapter 1: Introduction

This aim of the research within this thesis is to investigate the extent to which assessment impacts constructive alignment (CA) within a veterinary curriculum. Four research questions are generated following a review of the relevant literature at the end of chapter 2. The context of the study is the School of Veterinary Medicine and Science (SVMS) at the University of Nottingham which opened in 2006, with a novel, outcomes-based curriculum. This introductory chapter provides an outline of the structure of this thesis, describes the evolution of outcomes-based education (OBE) within veterinary education in the UK, and finally provides an overview of the SVMS curriculum.

Chapter 2 provides a review of the relevant literature to each of the studies within the thesis. This includes a review of OBE and the concept of CA; assessment of learning outcomes; approaches to learning and the transition from student to practitioner. Chapter 3 describes the research design and discusses the methods of data collection and analysis used in the thesis.

Chapters 4, 5 and 6 provide accounts of the 5 studies within this thesis. Chapter 4 describes study 1, defining the attributes of the Nottingham graduate and study 2, a survey of recent graduates as an indirect outcomes assessment. Chapter 5 describes studies 3 and 4 which both explore the educational impact of assessment formats used within the SVMS. Chapter 6 describes study 5 that investigates the impact of the transition to practice on student learning behaviour.

Chapter 7 provides a discussion of the results and draws conclusions about the extent to which CA exists within the SVMS curriculum including the effect of current assessment methods on achievement of the intended learning outcomes of the course. Figure 1.1 illustrates how each of the 5 studies contributes to the overall investigation of assessment and its effect on curricular alignment. A model of CA is used which shows the relationship between the curriculum and learning behaviour and the potential alignment of intended learning outcomes (ILOs) with the learning outcomes actually achieved by the students (SLOs). This diagram will be referred to throughout the thesis to place each study in the context of the overall investigation.

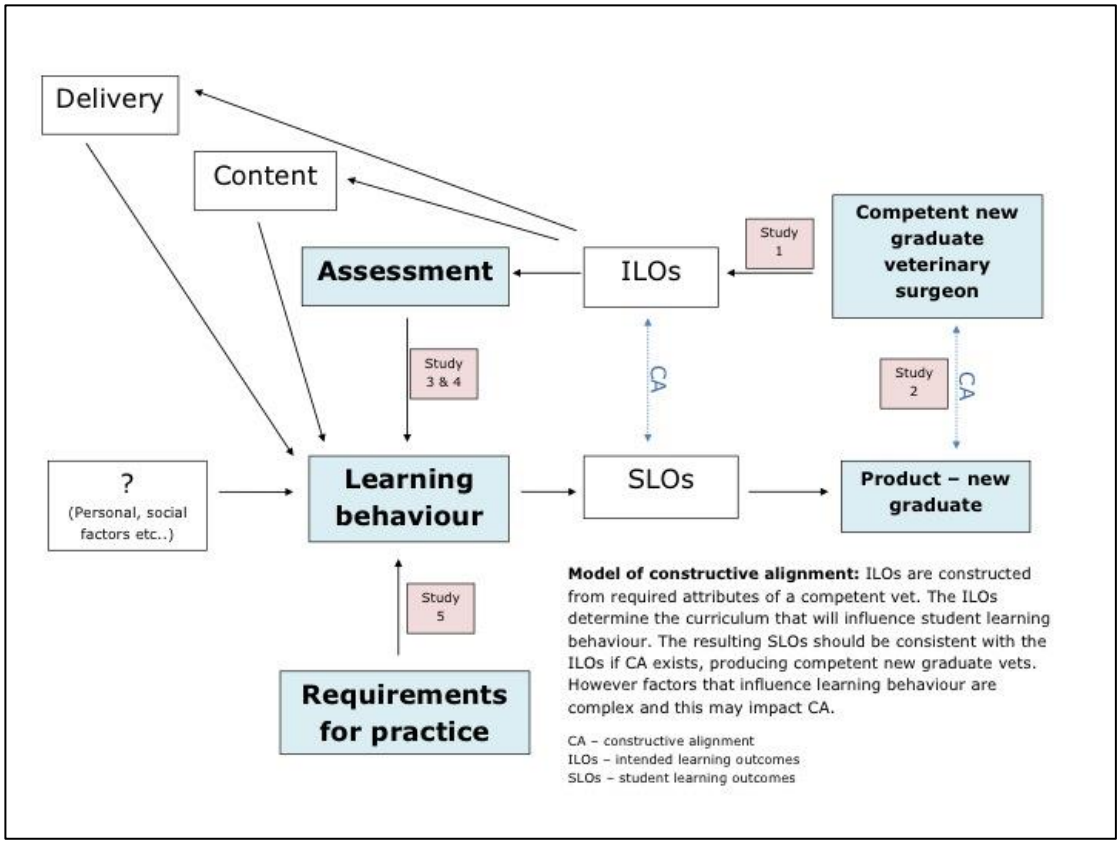

Figure 1.1: A model of constructive alignment (CA).

The alignment of the intended learning outcomes (ILOs) of the course and the actual learning outcomes achieved (SLOs) is dependent on student learning behaviour, which in turn is influenced by the curriculum. The areas of study within this thesis are shown on the model.

The research within this thesis was conducted over a 3 year period; the dates at which the individual studies were carried out are shown below:

April 2011

Study 3: collection of SPQ data

May – June 2011

Study 3: student interviews

September 2012

Study 1: staff focus group

November 2012

Study 1: staff survey

December 2012

Study 2: graduate survey pilot

January 2013

Study 2: graduate survey

May 2012 – April 2013

Study 4: delivery of SCT and collection of focus group and survey data

April 2013

Study 5: student survey

August 2013

Study 5: employer survey

1.1: The history of OBE within veterinary curricula

Before embarking upon an account of the structure of the SVMS curriculum, it may be useful to set it in the historical and wider context of veterinary education in the UK. Veterinary education was formalised in the UK with the introduction of the Royal Charter in 1844. This declares the Royal College of Veterinary Surgeons (RCVS) responsible for veterinary education and therefore a qualifying diploma was developed and administered by the College, in effect the vet schools provided the education, the RCVS provided the assessment.

At this time veterinary surgeons were required mainly to treat working horses and therefore equine studies provided a large proportion of the curriculum. In the first half of the 20th century, the future of veterinary education was however uncertain, replacement of horses by cars for much of the countries transport needs resulted in uncertainty as to what a veterinary graduate should be trained to do (Gardiner and Rhind, 2013). In effect this was probably the first major review of the ILOs of the veterinary curriculum.

In 1944 the Loveday report recommended several changes to veterinary education and this resulted in an emphasis on scientific knowledge underpinning clinical practice alongside inclusion of field stations and clinical facilities within vet schools (Gardiner and Rhind, 2013). Evidence of this content driven curriculum remains today in the requirements for accreditation in the UK and Europe, despite a shift by schools to a more outcomes-based approach (EAEVE, 2012, RCVS, 2011).

It was not until the end of the 20th century that the RCVS began to consider learning outcomes to inform veterinary education. Draft guidelines for the essential competencies of a veterinary surgeon were produced in 1998. However the introduction of the day one competences followed a consultation paper on veterinary education and training in 2001, recommending the competencies were confirmed as agreed policy by RCVS council as a matter of priority. The paper describes the day one competences as the minimum requirements for unsupervised practice but emphasises that this should be the starting point for a veterinary career not the end point (RCVS, 2001).

Much of this work was triggered by changes in the public's perception of the professions and regulatory professional bodies. Clients were becoming more knowledgeable and more demanding. In addition, the Veterinary Defence Society declared that a high proportion of new graduates were involved in the claims they received. To fulfil their statutory duty of regulating the professional conduct of veterinary surgeons and setting the standards for veterinary education, the RCVS employed an education strategy steering group to review the educational needs of the profession at both undergraduate and postgraduate stages. One of the remits of the group was to define the basic level of competence required on day one following graduation. These are the first learning outcomes described for all veterinary graduates in the UK. Subsequently revisions of this document have been produced, the most recent review by consultation occurred in 2013 and the revised document was published in 2014 (RCVS, 2014).

The professional development phase (PDP) has been subsequently introduced and became mandatory in 2007 (RCVS, 2007). The aim of the PDP is to allow new graduates to work towards first year competences in a more structured and supported manner, hopefully easing the transition to practice, protecting patient welfare and improving client satisfaction. The development and assessment of these year one competences is however variable amongst graduates and in the author's opinion, following discussion with stakeholders, the implementation of the PDP is likely to come under review in the near future.

The introduction of the day one competences required schools to include general professional skills to their curricula alongside the traditional science subjects. The emphasis on what the graduate can do, rather than what they know, has resulted in interventions such as the use of simulation, clinical skills labs, problem based learning and communication skills training using simulated clients to veterinary curricula (Baillie et al., 2005, Mossop and Gray, 2008, Baillie et al., 2010).

Learning outcomes are changing with the continually expanding knowledge and expertise within veterinary science. Whether all learning outcomes are achievable for all graduates across all species areas continues to be a matter for debate amongst veterinary professionals. The concept of 'tracking' a specific species area at undergraduate level has been considered and is discussed in greater detail in chapter 7 of this thesis. However, at present, the requirement for omnicomptenence at graduation remains. This is considered unrealistic by many stakeholders and the cause of much of the problems encountered by new graduates

and employers in the transition from vet school to practice (RCVS, 2001). This is likely to continue to be a matter for debate amongst the profession as veterinary curricula begin to creak under content overload.

Methods of teaching have been adapted to allow students to achieve the competences required at graduation, however, many schools rely on traditional forms of assessment. Whilst assessment practice has advanced with the introduction of formats such as the OSCE (objective structured clinical examination) (Bark and Cohen, 2002), assessment of students' performance in the workplace requires further attention. Examples of curricula exist where attempts have been made to assess performance at the program level (Bok et al., 2013) however, effective implementation is challenging and there is a lack of evidence for the impact of this kind of outcomes assessment on graduate performance.

The SVMS at the University of Nottingham was opened in 2006. The new curriculum was outcomes based and therefore had an emphasis on clinical and professional skills with case based learning used to contextualise the basic science delivered in the early years. The SVMS curriculum is described in the next section.

1.2: The SVMS curriculum

Students at the SVMS follow a 5-year course and are awarded the Bachelor of Veterinary Medical Sciences (BVMedSci) degree at the end of their 3rd year and the Bachelor of Veterinary Medicine Bachelor of Veterinary Surgery (BVM BVS) at the end of their final year.

The outcomes based curriculum is taught in systems based modules following a spiral model (figure 1.2). Students study each system with a focus on basic sciences in years 1 and 2 and then re-visit each system in years 3 and 4 where the emphasis is on the clinical science. Alongside these systems based modules, which are delivered in blocks of 2 – 11 weeks, run 3 long modules: Personal and Professional Skills, Animal Health and Welfare and Veterinary Public Health. These modules run throughout the year and are integrated with the concurrent systems based modules.

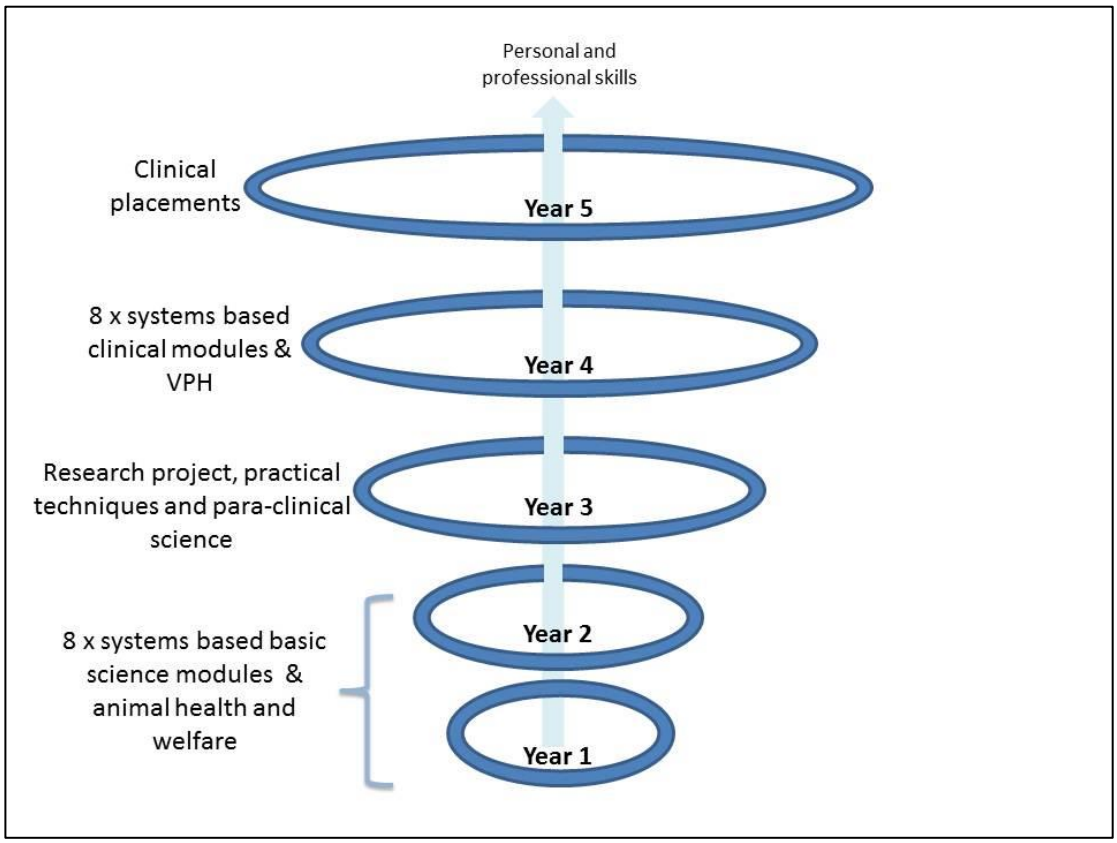

Figure 1.2: The SVMS spiral curriculum.

Learning outcomes are delivered in context with clinical examples and case studies from year 1. There is an emphasis on practical work including

laboratory techniques, clinical and professional skills. In years 1, 2 and 3 students are assessed using online multiple-choice questions (MCQ), short answer written questions and an objective structured clinical examination (OSCE) to reflect the practical content of the course. In years 1 and 2 this is termed an OSPE (objective structured practical examination) as the skills assessed are "practical" but not always "clinical" in nature.

During 3rd year, students undertake an individual research project, which runs for 12 weeks and is assessed by a written dissertation and a *viva voce* exam. This is followed by the principles of veterinary science module (PVS) that aims to consolidate the paraclinical subjects and the practical techniques module (PRT) that develops students' clinical skills in preparation for workplace based learning.

Students revisit the systems based modules during 4th year. The end of year examination consists of an online MCQ assessment and a written case based paper, which aims to examine functional knowledge and clinical reasoning. Students must have passed all 4th year examinations to progress onto the 5th year of the course. Figure 1.3 provides an overview of the 5 year course at the SVMS.

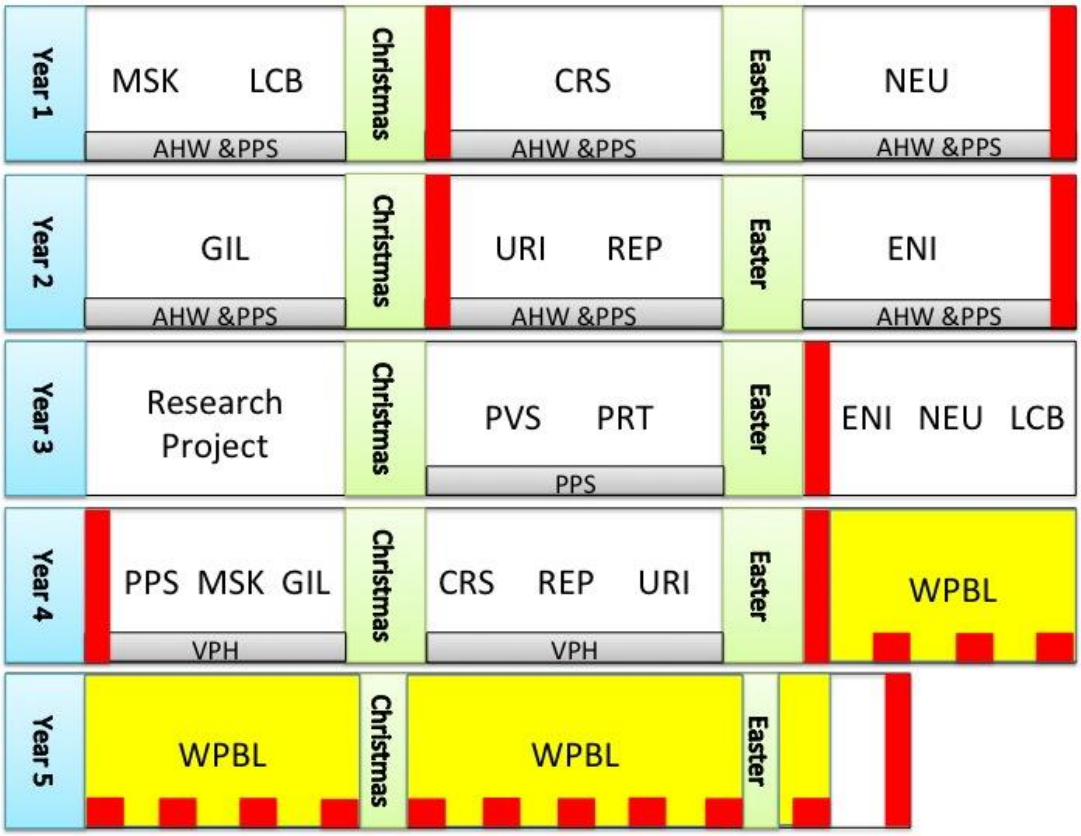

Figure 1.3: The SVMS curriculum overview

Key to the modules in figure 1.3: MSK, musculoskeletal; LCB, lymphoreticular cell biology; CRS, cardiorespiratory; NEU, neuroscience; GIL, gastrointestinal; URI, urinary; REP, reproduction; ENI, endocrine and integument; PVS, principles of veterinary science; PRT, practical techniques; AHW, animal health and welfare; PPS, personal and professional skills; VPH, veterinary public health; WPBL, workplace based learning.

In addition to the summative assessments already described, students must submit a reflective portfolio and a skills diary each year. The portfolio should provide evidence of their development as a veterinary professional and the skills diary demonstrates development of practical competence. The long modules have additional coursework requirements.

The 5th year of the course is a 'lecture-free final year' where students complete clinical placements at the university clinical associate practices. During this time they must pass 10 DOPS assessments (directly observed procedural skill) to be eligible to sit the finals examination at the end of

the year. A sample of one DOPS from each of 10 skill areas is assessed for each student in a range of different species. In addition to the DOPS, students must also pass a professionalism assessment for each two-week rotation block to be eligible to sit the finals examination.

The finals examination consists of multiple-choice questions (MCQ) and script concordance test (SCT) questions examined online, and assessment of a reflective portfolio. The written portfolio is assigned a mark based on criteria related to veterinary professionalism and student performance during a portfolio defence viva voce. A summary of all assessments within the SVMS curriculum is provided in table 1.1.

Assessment format	**Description**	**Year of study**
Multiple choice questions	Delivered online, includes extended matching, assertion reason and diagrammatic questions, intended to assess knowledge and the application of knowledge	1 - 5
Spot test	Short answer questions completed in response to trigger material at different stations, intended to assess knowledge and the application of knowledge	1 - 4
Oral presentation	Individual student presentations, intended to assess communication skills	2

Objective Structured Practical Examination (OSPE)	Series of 5 minute stations, intended to assess practical skills	1 - 2
Objective Structured Clinical Examination (OSCE)	Series of 5 minute stations, intended to assess clinical skills in a simulated environment	3
Dissertation	Submission of an individual student research project, intended to assess skills required for research and written communication	3
Clinical reasoning questions	Cased based, short answer questions, intended to assess clinical knowledge and reasoning ability	4
Directly Observed Procedural Skills (DOPS)	Workplace-based assessment intended to assess clinical skills	5
Script concordance test (SCT)	Questions delivered online around a clinical vignette, where student responses are compared to those of a panel of experts, intended to assess clinical reasoning ability	5
Portfolio	Electronic portfolio, student centred and intended to assess areas of professionalism, personal development and reflective practice	1 - 5
Viva voce	Used to defend individual student assessments namely the research project and final year portfolio. Intended to assess communication skills, knowledge of area of investigation and professionalism	3, 5

Table 1.1: SVMS undergraduate assessments

Successful completion of the finals examination results in the award of BVM BVS and automatic membership to the Royal College of Veterinary Surgeons.

1.3: Implications for Research

The evolution of outcomes based education within veterinary education in the UK has led to the development of a set of criteria which describe the minimum requirements for unsupervised veterinary practice, the day one competences. To ensure RCVS accreditation veterinary schools must provide evidence of undergraduate performance with respect to these competences. However, there are additional factors which influence the content, delivery and assessment of veterinary curricula. These include individual university regulations and requirements, the demands of the students, the profession and the public and finally other accrediting bodies for example the European Association of Establishments for Veterinary Education (EAEVE) and the American Veterinary Medical Association (AVMA). Satisfying the requirements of all stakeholders is problematic, which makes the design and delivery of outcomes based courses challenging. The result is often a lack of alignment between learning outcomes, teaching, learning and assessment. The extent of this alignment forms the basis for the research within this thesis, namely the impact of assessment on constructive alignment within the SVMS curriculum. A single, direct measure of constructive alignment does not exist. Therefore within this thesis students' learning behaviour associated with different assessments is investigated. Learning behaviour is, in part, determined by the curriculum and ultimately determines the outcomes achieved by students. It is therefore used here as an indirect measure of constructive alignment.

Chapter 2 provides a review of the relevant literature and subsequently four specific research questions are generated.

Chapter 2: A review of the relevant literature

2.1: Introduction

As outlined in chapter 1, the research area for this thesis is constructive alignment within a veterinary curriculum, with a focus on assessment and the impact this has on student learning outcomes. The research draws upon several areas of educational theory and the following literature review reflects this. Within this chapter the principles of outcomes-based education (OBE) will be discussed and applied to the context of veterinary curricula. Constructive alignment will be introduced as a framework for curriculum design and review. The evaluation of outcomes-based curricula will be discussed including formats used to directly assess students' performance. Student approaches to learning will be considered along with the factors that influence learning approach. Finally experiential learning will be discussed and its importance in making a successful transition from student to practitioner.

2.2: Outcome-Based Education (OBE)

2.2.1: An introduction to OBE:

The concept of outcomes-based education (OBE) was developed by William Spady in the late nineteen eighties. His vision for pre-university education in the United States was a system that focussed on what pupils could 'do' on leaving school as opposed to what they 'knew' (Spady, 1988). This model was adopted by medical educators a decade later in

response to general dissatisfaction with existing medical curricula and identification of a need for reform. In the UK, the General Medical Council (GMC) published *Tomorrow's Doctors* (GMCEC, 1993); this document outlined the attributes required of practitioners at the point of graduation. Medical schools were forced to review their curricula with less emphasis on course content and more importance placed on the performance of graduates.

One of the first and most notable examples of OBE within the healthcare professions was at Dundee Medical School (Harden et al., 1997). Regulatory bodies and individual schools have subsequently worked towards defining outcomes and implementing an outcome-based approach to teaching, learning and assessment. OBE has since been implemented by many other professional healthcare courses including veterinary medicine (Bok et al., 2011, Chapman, 1999, Chambers, 1998) and continues to provide a framework for curriculum development (Smith, 1999, Mulder et al., 2010, Davis, 2003, Davis et al., 2007) and educational research (Dawson et al., 2013, Harden, 2007, Jaarsma et al., 2009, Jaarsma et al., 2008).

2.2.2: Defining the principles of OBE

According to Spady (Spady, 1994):

"Outcome-Based Education means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences"

Harden (1999) states that OBE is easy to conceptualise but difficult to define. He describes OBE as:

"an approach to education in which decisions about the curriculum are driven by the outcomes the students should display by the end of the course."

Harden goes on to summarise OBE as "results orientated thinking" as opposed to "input-based education". OBE is often described as a top down approach beginning with the end product and working backwards: first what the graduates must be able to do is decided, and then the curriculum is developed to enable graduates to achieve the desired outcomes. From the defined exit outcomes, learning outcomes are developed for each phase and subsequently for individual learning experiences within the curriculum (Harden, 1999).

The development of OBE as an educational approach stems from the work of Carroll (1963) and Bloom (1968). Both authors identify the need for diverse instructional approaches to meet the learning needs of individual pupils. Bloom's mastery learning suggests that achievement is not based solely on aptitude, but given appropriate instruction and time to learn, the majority of pupils can achieve predefined learning outcomes. Davis (2003) maintains this principle, explaining how the relationship between time and learning is flexible in OBE compared to traditional education systems where the content to be delivered is defined for each academic year.

Traditional curricula define the content to be taught, describe the ways in which the content should be delivered and the methods of assessing the content. OBE differs from this traditional model; the outcomes not the

content to be inputted are initially defined. Subsequently the delivery and assessment methods are developed to enable individual learners to achieve the learning outcomes (Harden, 1999).

2.2.3: OBE within the healthcare professions

Within medical education, the concept of OBE has evolved; the result is competency based medical education (CBME). CBME first appeared in the literature in the 1970s (Brown et al., 1973, Spady, 1977) and has subsequently been described by several authors (Frank et al., 2010, Leung, 2002, Albanese et al., 2008, Epstein and Hundert, 2002, Carraccio et al., 2002). The defining principles of OBE are fundamental to the concept of CBME, evident in the four overarching themes described by Frank et al (2010): a focus on outcomes; an emphasis on abilities; a de-emphasis of time-based training and the promotion of learner-centredness. A competency-based approach has been described in a variety of healthcare educational settings (Chapman, 1999, Bok et al., 2011, Frank and Danoff, 2007, Chambers, 1998).

In CBME the outcomes are defined as competencies. One of the challenges of planning and implementing competency-based curricula has been the lack of consistent definitions.

One definition of a competency is:

"*the ability, based on integration of specific knowledge, skills and attitude, to perform a professional task at a level sufficient for unsupervised practice."* (Mulder et al., 2010)

Individual competencies are components of overall competence, defined by Frank et al (2010) as:

"The array of abilities across multiple domains or aspects of physician performance in a certain context."

The concept of competence is both dynamic and context specific. An individual's competence may be specific to a stage in their career or to a particular discipline and will change over time dependant on experience and setting (Koens et al., 2005). Therefore assessment of competence amongst veterinary students is challenging, especially considering the variety of species encountered in different contexts.

Evans and King (1994) describe OBE as having "an intuitive appeal that hooks people." However, although the principles of OBE and CBME are attractive in curriculum design, both have received criticism in practice.

2.2.4: Criticisms of OBE

Despite the move to OBE as a means to educational reform in the late eighties in the United States, many were unconvinced of the benefits of these new systems and OBE received much criticism. This could be attributed in part to a lack of conclusive evidence demonstrating the effects of OBE (Evans and King, 1994, Slavin, 1994). The following disadvantages of OBE have been documented.

2.2.4.1: Limiting students'' achievement

Setting predefined criteria for all students within an educational programme has been described as imposing constraints on the limits of education (Davis, 2003, Harden, 1999, Hussey and Smith, 2002). O'Neil

(1994) questions whether one set of learning outcomes are appropriate for all students. He asks the reader to consider students who will progress to Harvard University and those who will work as a 'clerk at K-Mart'. The career outcomes for those two groups of students are clearly different, is it appropriate that their expected educational outcomes are identical? Finally should all educational experiences have the purpose of enabling the learner to perform pre-determined outcomes? McKernan (1993) argues that academia should be valued in itself, OBE does not allow for this and limits learning to the development of set criteria.

Rees (2004) uses arguments put forward by Hussey and Smith (2002) to suggest that outcomes-based medical curricula not only risk limiting educational achievement but also lead to student disempowerment. Rees argues that even student centred approaches, such as PBL, "merely pay lip service to process" as facilitators guide students to achieve pre-determined learning outcomes. Both Rees (2004) and Hussey and Smith (2002) conclude that learning outcomes may be useful when interpreted in an appropriate context; they also warn universities against blindly adopting an outcomes-based approach to satisfy educational and professional regulatory bodies.

2.2.4.2: Loss of academic rigor

Learning outcomes, as proposed in Spady's transformational model of OBE (1994) are broad descriptions of student performance in authentic situations. He describes ten 'fundamental life performance roles' linking the school environment to real life settings. Critics of OBE have argued that the emphasis on broad, personal and social outcomes detract from

the academic rigor of a program (O'Neil, 1994), resulting in graduates lacking knowledge in traditional academic subjects. Within the healthcare professions, the influence of CBME has led to the implementation of a variety of student centred methods such as problem-based learning (PBL). These initiatives have also come under scrutiny, with concerns over the knowledge base of graduates from such programmes (Albanese and Mitchell, 1993).

Differences in performance between novice and expert clinicians have been explained in terms of content specificity (Eva et al, 1998). An appropriate knowledge base is required to manage cases in different disciplines and experts have had more experience and time to accumulate this knowledge. PBL programmes are student driven and lack the traditional approach of content based curricula. PBL graduates have been shown to perform less well in some assessments of clinical knowledge (Vernon and Blake, 1993). However, Norman (2002) argues that PBL curricula are superior when considering programme level learning outcomes and in creating a humane learning environment. Therefore potential gaps in students' knowledge may be evident in OBE, however, this is compensated for by the effects of the process on learning and more transferable learning outcomes.

2.2.4.3: Practicalities of OBE

It would be difficult to argue against the notion that individual learners progress at different rates and have preferences for different methods of teaching and learning. However, incorporating the needs of all individual learners within an educational setting poses several challenges. Staff

teaching load, curriculum timetables, availability of resources, assessment schedules and student fees are examples of some of the entities arranged around the 'academic year'. The requirement for students to progress through a curriculum at their own individual pace therefore poses logistical challenges within most educational settings (Hodges, 2010).

2.2.4.4: Assessment of students within OBE

Assessment of students within OBE systems relies on performance assessments that differ from traditional methods of assessment. Performance assessments require the learner to demonstrate an outcome and apply their knowledge and skills to a particular context. Traditional assessment formats are therefore insufficient within OBE and novel formats are needed to assess student performance even though they often rely on scant evidence to support their use (Marzano, 1994). Within veterinary and medical education there has been a drift towards competency assessment and specific formats will be discussed later in this chapter. However, with increasing use of competency based assessments there is a need for further research to support the validity of these formats within the context they are used (Holmboe et al., 2010, Norcini and McKinley, 2007).

2.2.5: Defence of OBE in the context of a veterinary curriculum

Harden (1999) argues that whatever criticisms OBE has received in other fields, within medical education, the performance of the doctor as a product of the course cannot be ignored. This is no different in veterinary medicine: graduation from any accredited vet school within the UK leads to automatic membership of the Royal College of Veterinary Surgeons and

a license to practice veterinary medicine. Graduation should therefore be an indicator of competence; graduates must have the ability to perform in practice to the standard required of a newly qualified veterinary surgeon in accordance with the RCVS Day One Competences (RCVS, 2014).

Whilst OBE has been criticised for limiting pupils' achievement, within veterinary education this can be viewed as an advantage (Davis, 2003). Universities have a duty to the public, accrediting bodies and to their veterinary students to graduate vets who are 'fit to practice'. Defining the components of veterinary clinical competence and ensuring all students achieve these standards at graduation is paramount for universities to fulfil this duty. Furthermore the RCVS Day One Competences were developed as a starting point for a veterinary career, a milestone in the continuum of veterinary education and lifelong learning (RCVS, 2001).

Within the revised RCVS day one competency document (RCVS, 2014) there is a notable emphasis on professional competences, including communication, reflective practice, leadership and teamwork in addition to the professional attributes described in the Code of Professional Conduct (RCVS, 2012). Previously veterinary education had focussed on the underpinning scientific knowledge required for clinical practice; the use of outcomes that define the performance of the veterinary graduate in the workplace incorporate the attitudes and behaviours essential for success in addition to the knowledge and skills required (Davis, 2003). A focus on these so-called 'soft skills' has resulted in a loss of academic rigour according to some critics (O'Neil, 1994, Harden, 1999). Whilst academic rigour must be maintained within any veterinary degree, the concept of

content overload within veterinary curricula is a growing concern and is recently discussed by May (2008). The shift towards OBE could influence a much-needed review of the content within veterinary curricula, with an emphasis on functioning knowledge (Biggs and Tang, 2010) that graduates will take with them on graduation for use in the workplace. Striking the balance between maintaining the content and academic rigor of a science degree and developing the requirements for clinical practice is challenging. In the author's opinion, this will continue to form the basis for much of the discussion surrounding veterinary curricula of the future.

Universities are increasingly accountable for the education they provide resulting in scrutiny from a number of stakeholders. Within the UK the RCVS is the major accrediting body, all schools are also EAEVE (European Association of Establishments for Veterinary Education) accredited and to date three schools have acquired AVMA (American Veterinary Medical Association) accreditation. In addition UK graduates must also have acquired the attributes required for the award of a professional qualification at Masters level of the national qualifications framework (set by the Quality Assurance Agency in the UK). OBE requires a set of defined standards against which educational programmes can be judged during evaluation and accreditation processes (Harden, 1999). Adopting an outcomes-based approach will therefore facilitate universities during accreditation processes.

Arguably the most important stakeholders to consider are the students. With recent increases in fees, students are demanding more education for their money (Jones, 2010). OBE provides a framework comprising of clear

and transparent outcomes, alongside appropriate learning activities and assessments to justify the educational philosophy and curriculum strategy. Potential advantages of OBE to the student learning experience include an emphasis on student-centred learning, integration of individual modules to achieve overarching goals, increased relevance to their future career and a set of pre-defined assessment criteria which they can work towards (Davis, 2003, Harden, 1999, Smith, 1999). However, students do not always receive outcomes-based interventions positively. Coe et al. (2012) describe the poor feedback received regarding a professional development module during student focus groups. Some students failed to see the relevance of the course content to their future careers in comparison to more traditional modules within the curriculum.

OBE has potential to enhance the student experience, emphasize accountability, provide a guide for curriculum content and assessment and produce graduates with a skillset relevant for day one practice. However, blindly adopting an outcomes-based approach does not guarantee success (Rees, 2004, Hussey and Smith, 2002). Defining the outcomes and providing the right learning environment and assessment tasks are essential (Biggs, 2003, Ramsden, 1984).

2.2.6: Constructing effective outcomes

2.2.6.1: Who is responsible for defining learning outcomes?

The outcomes-based approach has received criticism over learning outcomes which are written by course directors with little input from teachers or students (Hussey and Smith, 2002, Rees, 2004). It is important that outcomes are made clear to students, educators, the public

and employers; furthermore a wide range of stakeholders should be involved in developing the learning outcomes (Harden, 1999, Trent, 2002, Davis, 2003). To date, several studies have aimed to define the desired attributes of veterinary graduates (Doucet and Vrins, 2009, Heath and Mills, 2000, Mellanby et al., 2011, Rhind et al., 2011, Walsh et al., 2001); these attributes can be used to develop the learning outcomes of the course. Whilst these studies have successfully defined graduate attributes and ILOs in the context of their own institutions, these results are not necessarily transferable to other universities or countries.

2.2.6.2: How should learning outcomes be written?

Learning outcomes as described by Spady (1994) are the results of learning and are written using a verb to describe what action the student must be able to do. They are written in a way that informs all stakeholders exactly what the student should be able to do at the end of the course, using language that the student can understand. Students should be able to decide whether or not they have achieved the learning outcomes by a process of self-evaluation (Kerdijk et al., 2013).

2.2.6.3: What information should learning outcomes include?

Thompson and Bartels (1999) state that "outcomes should be multidimensional and holistic including the integration of knowledge, skills, attitudes and dispositions." Effective outcomes are not a list of topics to be covered during the course, the knowledge described should be functioning knowledge (Biggs and Tang, 2010) that students need to utilise in a clinical context. Comprehensive learning outcomes, not

restricted to technical or subject specific skills, are highly valued by students and educators (Brown and Edmunds, 2011).

2.2.6.4: The three-circle model

The three-circle model was proposed by Harden (1999) to describe the learning outcomes of a medical curriculum (Figure 2.1). This model represents what the doctor does (the inner circle), the way in which those duties are performed (the middle ring) and finally the aspects of professionalism which are embedded within the context in which the tasks are performed (the outer ring).

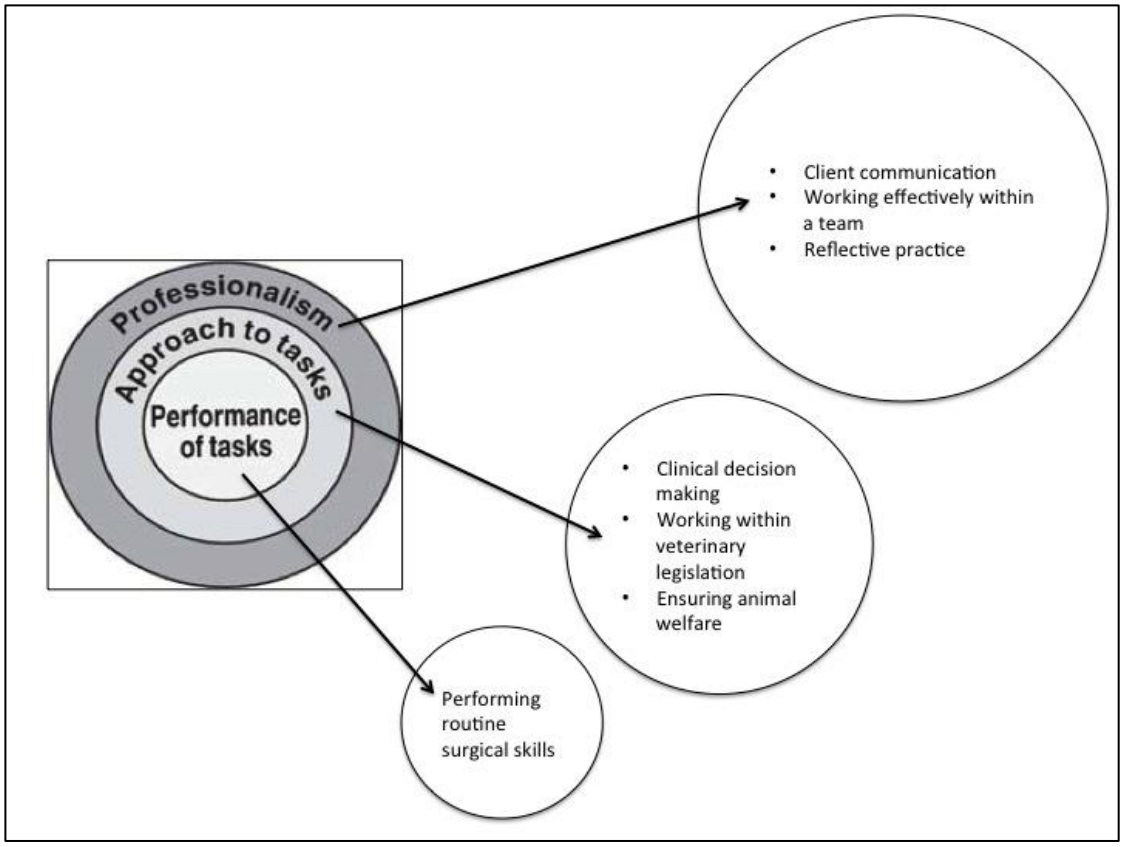

Figure 2.1: A three-circle model representing educational outcomes (Harden 1999). Adapted to demonstrate application to a veterinary context: performing routine surgical techniques

This could also be applied to learning outcomes for a veterinary graduate. For example very simply, the task could be perform routine surgical techniques; outcomes which describe the approach to the task would include working within veterinary legislation and ensuring welfare of animals at all times; finally the outcomes relating to professionalism include displaying empathy in client communication and effective inter-professional interaction to maximize patient outcomes.

So far, this chapter has discussed the principles of OBE and the advantages to this approach within veterinary education in the UK. Although OBE has its critics, it is a widely accepted model, implemented in many healthcare contexts (Harden et al., 1997, Bok et al., 2011, Frank and Danoff, 2007, Mulder et al., 2010). Different interpretations of OBE exist and the following section explores one such application: the concept of constructive alignment that will provide a framework for the research within this thesis.

2.3: Constructive alignment

2.3.1: The principles of constructive alignment

Constructive alignment (CA) is a form of OBE, first described by Biggs (1996) as a teaching and learning strategy where learning objectives are explicitly defined and represent the intended learning outcomes (ILO) of the course. The theory of constructive alignment describes how learning outcomes should be achieved through teaching, learning and assessment activities that provide opportunities for learners to achieve and demonstrate the ILOs. Consideration of this concept in greater depth uncovers two fundamental aspects (Biggs, 2003). Firstly constructivism,

which can be defined as the construction of new meaning by the learner (Piaget, 1962). The constructivist student learns through discovery rather than merely the transfer of information from teacher to student (Biggs, 2003). Constructivist education is therefore more than the acquisition of new knowledge; it promotes the development of critical thinking (Joseph and Juwah, 2012).

The second aspect to consider is alignment (Biggs, 2003), which is the role of the teacher in ensuring all learning activities are appropriate and therefore allow students to meet outcomes. The ILOs require higher-level cognitive skills; the teacher must provide learning activities that foster development of such skills. In addition the learning environment must support this development and students are required to demonstrate the ILOs through appropriate assessments. Alignment of teaching, learning and assessment with the ILOs results in the learner being 'trapped' unable to escape without learning what was intended (Biggs, 2003). Within CA learning outcomes are explicitly defined and made available to the student. There is a greater emphasis on the student to enable effective learning to take place rather than the activities of the teacher (Biggs and Tang, 2010).

2.3.2: Examples of CA in curriculum design and development

CA can provide a useful theoretical framework for curriculum development. Joseph and Juwah (2012) used CA theory to develop a nursing skills curriculum, the benefits included increased opportunity to practice skills and increased confidence in the students who experienced the CA curriculum compared to a control group. Chadwick (2013)

proposes CA as a framework for enhancing orthodontic training; he emphasizes the importance of the relationship between universities and regulatory bodies to ensure success. Walsh (2007) explores the work of Biggs in relation to work-based learning. She suggests that the workplace provides a context that will allow active learning and generate a high level of motivation; consistent with the student-centred learning within CA. Walsh goes on to discuss the role of assessment in CA and its influence on student learning behaviour. She acknowledges the need for performance assessment within work-based learning, however, she fails to address some of the challenges these assessments provide.

CA theory is referred to within the context of veterinary education as a framework for curriculum development and evaluation and several papers provide examples. Haarala-Muhonen et al (2011) use CA theory in the comparison of students' perceptions of their teaching-learning environments in veterinary medicine, law and pharmacy. The results of the study were fed back to faculty and used to implement curriculum changes within the faculty of law. However, these results do not appear to have a direct impact on teaching, learning and assessment within veterinary medicine and pharmacy.

In a review of competence assessment in veterinary graduates CA theory is used to emphasize the importance of assessment within curriculum design (Rhind, 2006). Rhind states that integration of knowledge and skills are essential for a valid assessment of veterinary clinical competence and strategies that focus on sub-components of competence in isolation are not consistent with CA.

In a paper describing the process and implementation of curriculum mapping, Bell et al (2009a) concluded that CA between course learning objectives and assessment tasks needed improvement. They recommend consideration of CA during the curriculum mapping process through mapping of assessment tasks to learning outcomes. However, the authors acknowledge that the project involved a considerable amount of staff time and therefore this recommendation may not be achievable with existing resources.

Finally, in the design and evaluation of an individual teaching activity, Canfield and Krockenberger (2002) use the SOLO taxonomy (Biggs and Collis, 1982) to maximise constructive alignment. Results of the evaluation showed this approach to be successful in achieving desired learning outcomes through a student centred approach (Canfield and Krockenberger, 2002). These conclusions are based on students' and tutors' perceptions of the teaching activity. The study did not include direct assessment of the learning outcomes, which is an essential component to the principle of constructive alignment.

Only a small number of studies exist relating to CA within veterinary education. From this limited research it is apparent that CA is considered an important concept to ensure a successful outcomes-based curriculum. However, the principals of CA are challenging and time consuming to implement. Furthermore evidence of the impact of using CA as a framework for curriculum design is lacking.

2.3.3: To what extent does constructive alignment exist within higher education?

Biggs (2003) illustrates how the conditions of CA are not met in some higher education courses. Course literature often describes an environment where students will develop a deep understanding of their chosen subject and be required to think creatively to solve problems. However, in reality many of these courses deliver the curriculum through large lectures and assess recall of the factual content of the curriculum through formats such as multiple-choice questions. Neither the delivery nor the assessments are aligned to the aims of the course. May (2008) suggests that within many modern veterinary curricula, there is a lack of CA with a focus on delivering and assessing declarative knowledge (Biggs, 2003) at the expense of functioning knowledge.

Harden (2001) suggested there are three different perspectives on a curriculum: the declared (in course documents), the taught (as perceived by tutors) and the learnt curriculum (as perceived by students) illustrated in figure 2.2. (Harden, 2001). In an ideal situation these versions would be the same, in reality they are likely to be different.

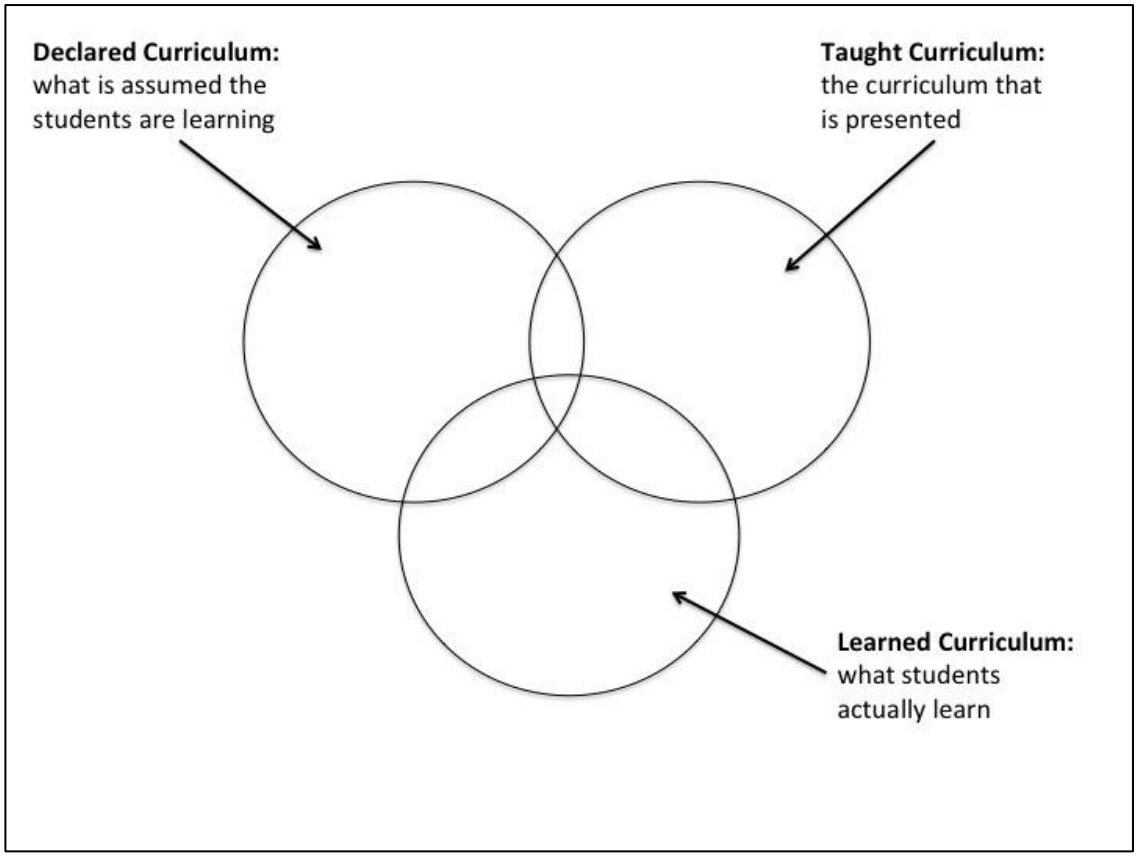

Figure 2.2: The declared curriculum, the taught curriculum and the learnt curriculum (Harden 2001)

When considering the concept of constructive alignment a fourth perspective exists: the assessed curriculum. This should arguably be added to Harden's curriculum model. It is widely accepted that assessment drives student learning (Newble and Jaeger, 1983, Marton et al., 1992, Cilliers et al., 2010, McLachlan, 2006), therefore the assessed curriculum must be included within curriculum design and review. Assessment has a considerable influence on the learned curriculum and relating the declared curriculum to the ways in which students are taught and assessed is essential to maximise alignment (Fuentealba, 2011).

The above considerations were concerned with the principles of OBE and CA. The following section will discuss evaluation of outcomes-based programmes, namely outcomes assessment.

2.4: Outcomes assessment

The veterinary profession has undergone significant changes in recent years and advances in education are necessary to meet the changing demands of society on veterinary graduates (Pritchard, 1988, Radostits, 2003, Fernandes, 2005). The requirement for curriculum review will continue into the future (May, 2008) therefore a robust process of evaluation and improvement is needed. Outcomes assessment (OA) describes the process of review and evaluation of an outcomes-based curriculum, with the aim of improving teaching and learning (Trent, 2002). Dhein (2002) describes OA as a form of quality assurance; she acknowledges that currently the process is variable amongst veterinary schools, but proposes that accrediting bodies work alongside universities to produce a more standardized process in the future.

OA is already a required element of accreditation in the United States (Trent, 2002, AVMA, 2014). The American Veterinary Medical Association (AVMA) Council on Education (COE) is responsible for the accreditation of veterinary programs within the United States and Canada; AVMA accreditation is required for licensure to practice for the majority of state licensing boards within the US. There are 11 standards required by the COE for accreditation; standard 11 is outcomes assessment. The standard states that outcomes of a program must be 'measured, analysed and considered to improve the program.' In addition student achievement

must be considered both pre and post-graduation within the outcomes assessment (AVMA, 2014). OA is not specifically referred to by the RCVS in their requirements for approval of veterinary degrees, however it is a requirement to ensure methods are in place to 'monitor and amend the curriculum if necessary' (RCVS, 2011). Furthermore it is essential that this process of self-regulation maintains public confidence in the profession (Kochevar, 2004), which may call for a more collaborative approach to outcomes assessment in the future.

Edmondson (2004) relates OA to student learning. Just as assessment and student feedback enables modification and improvement in future learning, assessment of an entire program is important to identify areas for curricular review and development (Edmondson, 2004). Similarly Thompson and Bartels (1999) stress the importance of providing meaningful feedback to university staff and the public on student and alumni performance. Trent (2002) states that the feedback from OA should be generated from a variety of sources including students, alumni, faculty, employers of the graduates and sometimes clients. OA usually involves an evaluation of the end product, although consideration of input factors and process factors are equally important. Input factors are defined as the quality of the students, staff and resources; process factors comprise teaching learning and assessment (Trent, 2002).

The process of conducting OA as described by Trent (2002) begins with deciding on outcomes to be assessed, which should be 'specific and measurable results'. This definition differs from the outcomes described by Harden (1999) and Spady (1988) that describe attitudes and behaviours

that can be difficult to demonstrate and measure. Subsequent stages in OA are planning the process and participants; selecting and implementing data collection methods; ensuring the findings impact future learning and finally reviewing the outcomes assessment process (Trent, 2002).

Methods of assessing outcomes include both direct and indirect assessments (Trent, 2002, Kochevar, 2004). Direct methods include measures of student performance, whereas indirect assessments involve collating the opinions of various stakeholders including staff, students, alumni, employers and clients. The role of direct and indirect outcomes assessment in the curriculum review process is illustrated in figure 2.3.

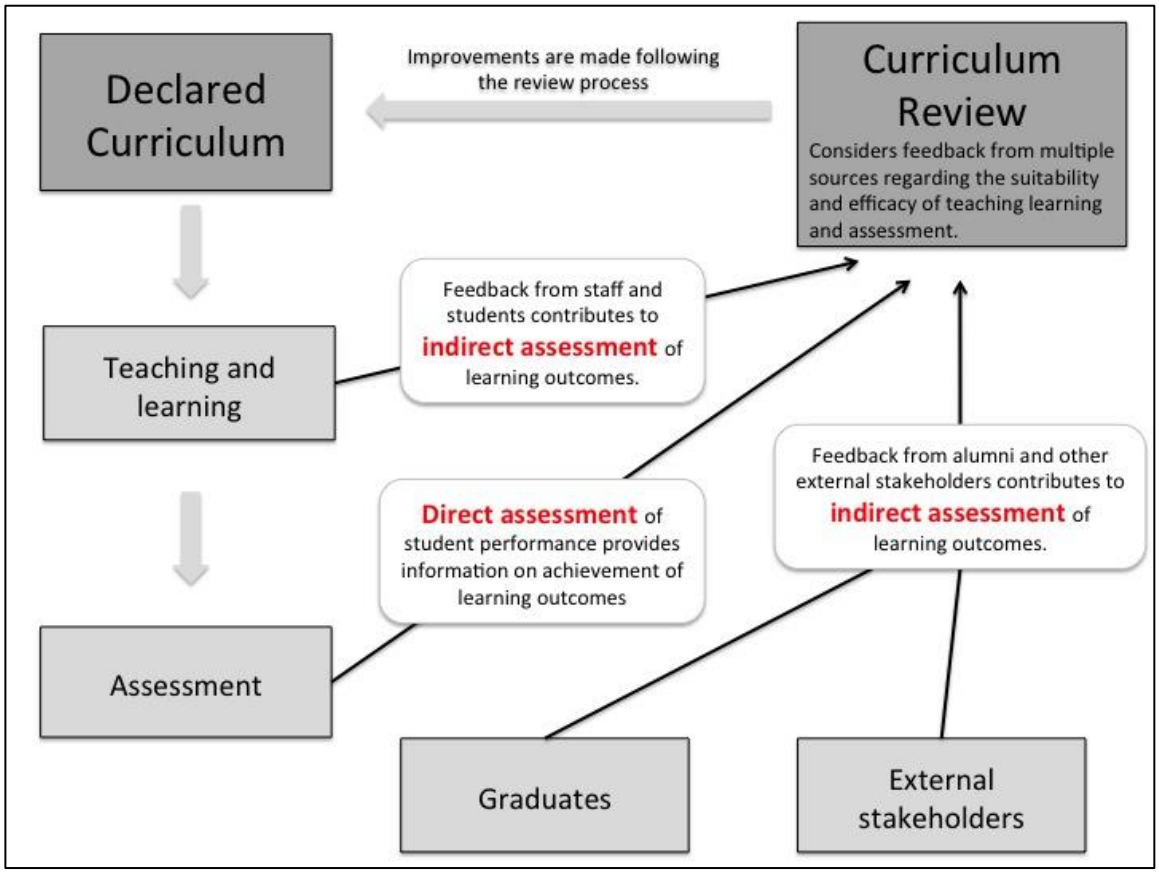

Figure 2.3: The role of direct and indirect assessment of intended learning outcomes in the curriculum review process.

2.5: Indirect outcomes assessment

The aims of indirect OA is to ascertain whether graduates achieve the intended learning outcomes of the course and meet the expectations of the profession (Walsh et al., 2002). One commonly used example of indirect OA are graduate surveys that provide an insight into the opinions of graduates on their learning experience and preparation for the workplace (Trent, 2002, Bristol, 2002, Hardin and Ainsworth, 2007). Several papers report the variety of methods used within OA across different universities, including surveys of employers, students, faculty, alumni, referring veterinary surgeons and data collected by external organisations (Walsh et al., 2002, Black et al., 2002, Butler, 2003, Doucet and Vrins, 2010, Kleine et al., 2002, Greenfield et al., 1997). However, common to all these approaches to OA should be a well-designed data collection exercise, the results of which should be shared with stakeholders and used to inform the future curriculum (Kochevar, 2004).

This approach to OA has been used in settings other than veterinary medicine (Peters et al., 2000, Rowe et al., 2004). The New Pathway Program at Harvard Medical School was designed to re-enforce and contextualize outcomes related to humanistic medicine, social and lifelong learning. Peters et al (2000) compared two groups of students, one group following the traditional curriculum and the other group following the New Pathway Program. They concluded that ten years post-graduation differences remained between participants from the two groups. This example demonstrates the use of OA in the longitudinal assessment of graduates to evaluate major changes to the curriculum.

The initial stage of deciding on the outcomes of learning may include the results of existing studies providing information as to the desired attributes of graduating veterinary surgeons (Kochevar, 2004). Walsh et al (2001) defined the expected attributes of veterinary surgeons graduating from the University of California, Davis. In a second study these attributes are used to measure employer perception of the graduates' abilities (Walsh et al., 2002). During this OA knowledge of veterinary private practice was identified as a deficit amongst graduates and subsequently a working party was set up to develop a curriculum for professional development and career success (Lloyd and Walsh, 2002). This series of studies demonstrates the importance of OA in the cycle of curriculum review.

A report from the Virginia-Maryland Regional College of Veterinary Medicine (Black et al., 2002) describes the process of OA applied across all 11 AVMA accreditation standards. The aim of the survey, administered to a wide range of stakeholders, was to provide information on each of the accreditation standards, alongside the traditional report which details the inputs and processes involved in each area. The breadth of this study and range of participants resulted in more information than just performance of graduates and the authors acknowledge that this was a resource intensive process. However they conclude that the benefits of a more in depth, objective review were invaluable to the cycle of course evaluation and subsequent improvement.

There are challenges to the conclusions drawn from data collected in this way. Response rates from graduates and employers who are not working

within the university are variable. Danielson (2012) surveyed employers of graduates from Iowa State University; 38% of employers completed the questionnaire. Doucet (2010) surveyed alumni and their employers and reports response rates between 24% and 78% for different year groups. Kleine et al (2002) report response rates of 60% for alumni, but only 12% for the employers in a survey in 2000. Small sample sizes may not represent the opinions of all alumni and employers and response bias should be considered.

It is widely recognised that data obtained from surveys is prone to error (Alwin, 1991, Rea and Parker, 2012) due to participants, the purpose of the survey, questionnaire design and method of administration. Doucet (2010) reported a difference between employer and graduate perception of the graduates' abilities. She suggests new graduates underestimate their abilities during self-evaluation. As many studies rely on alumni to self-assess (Kleine et al., 2002, Hardin and Ainsworth, 2007, Bristol, 2002, Doucet and Vrins, 2010, Black et al., 2002, Butler, 2003) interpretation of results should be done with caution. Butler (2003) measured employer satisfaction with new graduates. Outcomes were assessed on direct performance of employees and inter-rater variability due to untrained assessors is acknowledged.

Finally in the absence of a standardised approach to OA, comparisons between institutions are difficult (Bristol, 2002). Furthermore any conclusions drawn are limited to the context of the university and the area of practice investigated (Greenfield et al., 1997). A lack of generalizable

conclusions and inability to compare results across institutions limits the use of OA studies in curriculum development.

Despite these limitations, there are clear advantages to indirect measures of learning outcomes. When used in combination with other sources of information including direct assessment of performance and analysis of input and process factors, indirect OA is a valuable component of curriculum review (Trent, 2002).

2.6: Direct assessment of student performance

Student assessment at the SVMS begins soon after they arrive in the first year of the course; it comprises a range of different assessment formats and is both summative and formative. This section will review general considerations regarding the assessment of competence in veterinary students; assessment in both formative and summative contexts will be discussed and finally there will be a focus on the assessment formats studied within this thesis, namely multiple choice questions (MCQ) workplace-based assessment (WPBA) and the script concordance test (SCT).

2.6.1: Assessment of clinical competence.

Clinical competence has been defined as the integration of knowledge, skills and attitude to perform in a professional context (Mulder et al., 2010, RCVS, 2014, Dent and Harden, 2013). Measuring competence is challenging and no single assessment format is able to fulfil this requirement (Hardie, 2008, Holmboe et al., 2010). It might be reasonable to assume that the essential components of competence, knowledge, skills and attitudes, could be assessed as individual constructs and the results

combined to produce an overall measure of clinical competence. However, this approach can result in a fragmented assessment strategy in an attempt to incorporate all subcomponents of competence (Rhind, 2006, Van Der Vleuten, 1996) and it is argued that there is an over-emphasis on the objectification of assessment at the expense of more meaningful qualitative judgements (Wass et al., 2001, Holmboe et al., 2010). Whatever definition is accepted, domains of clinical competence are neither stable nor generic traits and therefore competence should not be broken down into constituent parts for assessment purposes (Schuwirth and Van der Vleuten, 2011a).

Following on from the idea of assessing individual components of clinical competence, current thinking includes the implementation of a range of assessment tools in different contexts to build a picture of an individual's ability (Holmboe et al., 2010). Selection of appropriate assessment strategies is as important as defining the content and delivery of a curriculum (Fuentealba, 2011). As discussed previously, assessment, teaching and learning must all be aligned to pre-defined learning outcomes to fulfil the requirements of constructive alignment (Biggs, 2003, Bell et al., 2009a).

Consideration of the standard to which the learning outcomes must be demonstrated is essential (Harden, 1999). For example does the student simply need an awareness of a procedure or must they be able to competently perform the procedure unsupervised at the time of graduation? Miller (1990) constructed a pyramid to illustrate stages in the development of clinical competence (Figure 2.4).

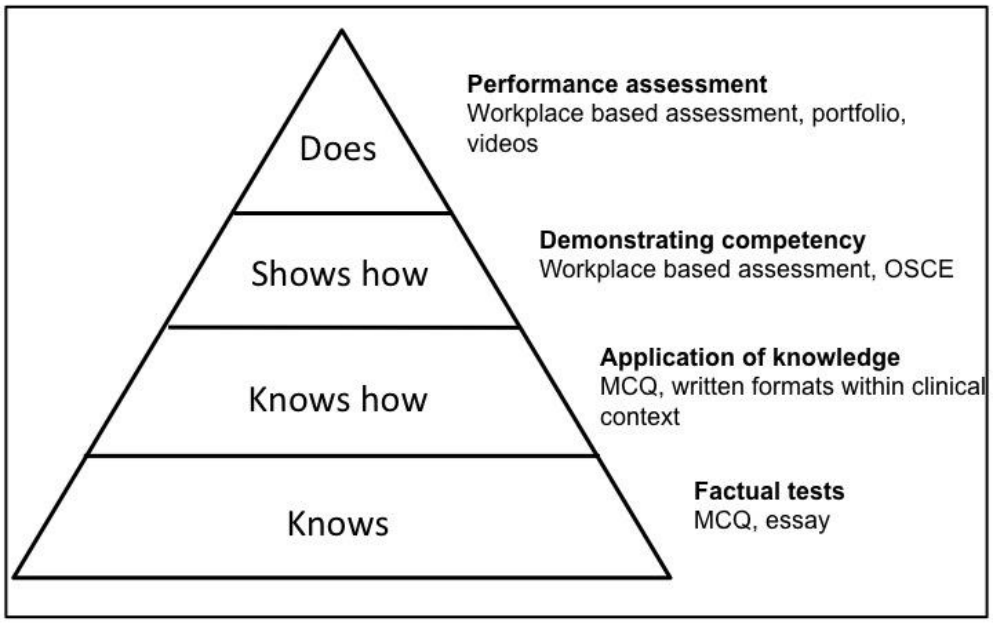

Figure 2.4: Miller's Pyramid of competence (Miller, 1990)
Adapted to show appropriate assessment formats for each stage.

Factual knowledge sits at the base of the pyramid as a foundation on which competence is built. As a student progresses they must be able to apply their knowledge at the 'knows how' level. Clinical competence is not just a cognitive function; at the 'shows how' level a student must demonstrate a competency albeit in a simulated environment. The top level of Miller's pyramid 'does' refers to performance of the clinician. Demonstration of a competency at the 'shows how' level is not necessarily representative of everyday performance in practice; effective performance assessment is the ultimate goal within OBE. Clearly the assessment tool selected will depend on the stage of the course and standard required.

Within assessment design the level of expertise should also be considered (Wass et al., 2007). Bloom's taxonomy (Bloom and Krathwohl, 1956) provides a useful framework for the progression of knowledge from novice

to expert; this framework was later revised by Anderson et al., (2001) (Figure 2.5). Expertise increases throughout a course, it is therefore likely that programme ILOs consist of higher order knowledge and assessment tasks should reflect this.

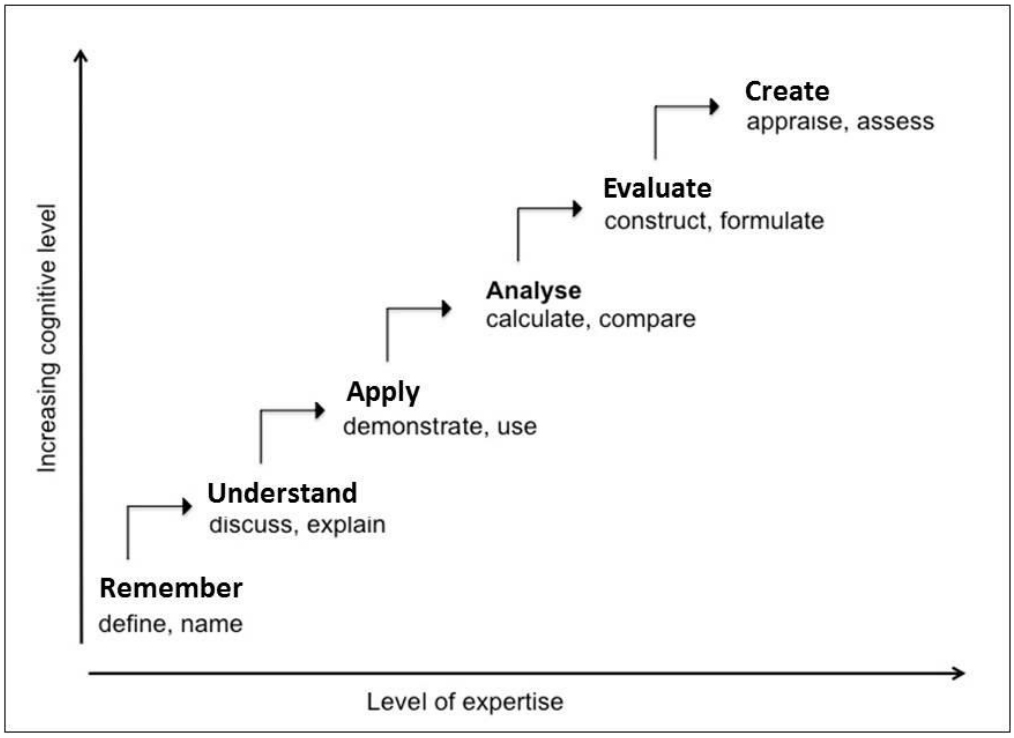

Figure 2.5: Bloom's Revised Taxonomy (Anderson et al., 2001)

Traditional assessments focus on declarative knowledge and completion of a set task that may or may not reflect the ILOs of the course (Biggs and Tang, 2010). Examples of assessment formats that meet the requirements for CA include performance assessments and portfolios. Performance of veterinary students can be assessed through workplace-based assessment (WPBA) that offers the advantage of providing feedback to the student on their clinical ability (Norcini and Burch, 2007). Portfolios have the potential to assess all three levels of learning outcomes described by

Harden (1999) including attitudes and professionalism (Davis and Ponnamperuma, 2005). Students select a range of evidence to demonstrate they have achieved the ILOs of the course. When used effectively portfolios provide a student driven method of assessment that promotes elements of competence such as reflective practice, self-assessment and lifelong learning (Driessen et al., 2005). Both WPBA and portfolios have the potential to provide authentic assessments in healthcare settings (Norcini and Burch, 2007, Prescott-Clements et al., 2008, Driessen et al., 2005) however appropriate implementation is key to maximise their educational use (Davis and Ponnamperuma, 2005, Norcini and Burch, 2007, Wilkinson et al., 2008).

Although portfolio and WPBA formats potentially meet the requirements of an assessment strategy for OBE, selection of any assessment must be given careful consideration. To evaluate the utility of a given assessment format, Van der Vleuten (1996) proposed the following equation:

Utility = Reliability x Validity x Feasibility x Acceptability x Educational impact

This is not to say that some numerical value can be assigned to an assessment to measure its worth, but each component of the equation must be considered in context. Compromise of one or more components is inevitable, for example WPBA has been praised for providing feedback on the tasks graduates will perform in practice. However, questions have been raised with regards to the reliability of WPBA and the suitability of such formats for making summative judgments (Wilkinson et al., 2008). On the other hand, a well-constructed set of MCQs can provide a reliable test of knowledge but will not be able to assess some of the skills,

attitudes and behaviours needed in practice (Wass et al., 2001, Rhind, 2006). The following sections will consider each of the components of the utility equation in further detail.

2.6.1.1: Validity

Validity is concerned with the extent to which an assessment tests what it is designed to test. Much debate exists over both the definition and methods of evaluating validity (Colliver et al., 2012). When examining validity Hecker and Violato (2009) describe 4 levels of analysis: face validity, content validity, criterion-related validity and construct validity. The definitions provided in table 2.1 will be assumed throughout this thesis with reference to validity.

Type		Definition
Face		The extent to which a test appears practical, pertinent and related to its purpose (Mosier, 1947)
Content		The adequacy with which the instrument samples the domain of measurement (Hecker and Violato, 2009)
Criterion		A comparison of test scores with one or more external variables (criteria), considered to provide a direct measure of the characteristic or behaviour in question (Messick, 1990)
	Predictive	The certainty to which a test can predict future performance (Dent and Harden, 2013)
	Concurrent	The degree to which scores on a test correlate with the scores on an established test administered at the same time (Dent and Harden, 2013)
Construct		The measurement of some attribute or quality which is not operationally defined (Cronbach and Meehl, 1955)

Table 2.1. Definitions of validity

The definitions in table 2.1 are useful to explain the concept of validity for an assessment. However, current thinking proposes that all validity is construct validity defined as the extent to which the interpretation of the test score can be relied upon (Downing, 2003b, Messick, 1990). Fundamental to this unitary view of validity is the point that it is not the test or test score which is validated, but the interpretation and inferences which can be made from this information (Cizek et al., 2008). Colliver et

al. (2012) argue that this current approach is problematic, as theoretical nomological networks do not exist to validate the constructs. Consequently multiple sources of validity evidence are required (Downing, 2003b) and types of validity can provide guidance for collating appropriate evidence (Hecker and Violato, 2009). Kane (2013) proposes an interpretative use argument (IUA) to provide evidence of validity. He describes four types of evidence that should be collated within a validity argument relating to scoring, generalizability, extrapolation and the interpretation or decisions made based on the results. Regardless of any consistent definition, it is important to note that when considering validity any one assessment format cannot be valid in itself but has more or less evidence to support its use in a specific context (Schuwirth and Van Der Vleuten, 2011b).

2.6.1.2: Reliability

Similar to validity, multiple definitions of reliability exist. Hecker and Violato (2009) describe reliability as the consistency of measurement and a necessary condition for validity. Alternative definitions describe reliability as an estimate of the amount of measurement error in a test (Tavakol and Dennick, 2012) and the extent to which the scores on a test are reproducible (Schuwirth and Van Der Vleuten, 2011b). Traditional methods of measuring reliability include Cronbach's alpha and the Kuder-Richardson 20 formula. However these values do not provide information on the various sources of error. The use of advanced psychometric methods in addition to classical test theory is therefore encouraged to improve the quality of high-stakes examinations (Tavakol and Dennick, 2012).

Generalizability theory can be used in psychometric analysis to determine the contribution of different sources of error to the overall variation in assessment scores. For example, in an OSCE individual students' scores will vary according to their ability to perform the task in each station. However, unwanted sources of error also contribute to variation in scores, such as assessors, simulated patients and different stations. A G-coefficient can be calculated to determine how reliable or generalizable the scores are. The higher the G-coefficient (closer to 1.0), the more generalizable the score and there is less influence from unwanted sources of error (Tavakol and Dennick, 2012, Schuwirth and Van Der Vleuten, 2011b). This information can then be used to minimise the unwanted sources of variation. Furthermore, decision studies can then be used to predict the effects of manipulating the assessment design on generalizability (Tavakol and Dennick, 2012).

2.6.1.3 Feasibility

Feasibility refers to how easily an assessment can be implemented within the curriculum. Some formats can be more costly in terms of time and resources to deliver. For example, a viva voce examination might be favoured by some academics over a written examination. However to achieve acceptable levels of reliability increased testing time is required, involving multiple examiners and clinical cases (Wass et al., 2003) which may not be possible. When considering OBE and the individual student, feasibility of assessment becomes increasingly important. It is unlikely that universities, working within the academic year, have the resources to accommodate assessment of an individual's performance as they progress at their own rate (Hodges, 2010).

2.6.1.4 Acceptability

Any assessment must be acceptable to all stakeholders to be successful (Dent and Harden, 2013, p.323). Acceptability is the extent to which all those involved endorse the assessment (Norcini and McKinley, 2007) and regardless of the educational theory underpinning an assessment strategy, buy in from staff, students, clinicians and clients is essential.

2.6.1.5 Educational Impact

Educational impact refers to the influence of assessment on the learning process and is often termed consequential validity (Swanwick, 2010, p.198). The relationship between assessment and learning has been repeatedly acknowledged at all stages of education (Biggs, 1987, Crooks and Mahalski, 1985, Gibbs and Simpson, 2004, Ramsden, 1992, Cilliers et al., 2010, McLachlan, 2006, Scouller, 1998) although the exact nature of the relationship is unclear. The educational impact of assessment has been previously explored (Newble and Jaeger, 1983, Evelyn Brown, 2003, Ringsted et al., 2004, Cilliers et al., 2010, Cilliers et al., 2011, Scouller, 1998, Leung et al., 2008, Donnon and Hecker, 2010) and has been shown to have both a positive effect on student learning (Newble and Jaeger, 1983, Gibbs and Simpson, 2004, McManus et al., 1998, Ringsted et al., 2004) as well as fostering less desirable learning strategies (Scouller, 1998, Leung et al., 2008, McManus et al., 1998). Van Der Vleuten and Schuwirth state that there is a lack of empirical evidence to explain how assessment influences learning behaviour, however it is clear that the impact of any given format is strongly context dependant (Van Der Vleuten and Schuwirth, 2005).

Whilst the content of an exam has a more obvious impact on students' learning, it is not clear how other factors influence this process. Some evidence suggests the assessment format plays a major role in educational impact (Scouller, 1998, Tang, 1994) although the content and level at which this is tested is likely to differ between formats in these studies and this must be considered when interpreting results. Cilliers et al., (2010, 2011) proposed a mechanism for the impact of assessment on the learning behaviour of medical students. They identified several factors including the stage of the course, the consequences of the assessment, the perceived cognitive demands of the task and the proximity of the assessment that all contributed to the educational impact. Similar influences have been identified in other contexts (Seale et al., 2000, Gibbs and Simpson, 2004, Donnon and Hecker, 2010, Gibbs and Dunbar-Goddet, 2009) and there is a clear balance between investment of time and effort and perceived gain by the student. The mechanism of the impact of assessment is complex and individual students appear to weigh up several factors before adopting a learning approach.

Whilst there is a call for further research into the influence of assessment on learning (Cilliers et al., 2010, Van Der Vleuten and Schuwirth, 2005) providing evidence of this mechanism is challenging. Impact can be defined as "a marked effect or influence"; finding ways to measure influence on students' learning is difficult. Demonstrating a direct effect of an assessment on the learning process, that is both complex and individualised, is inevitably problematic. The notion of educational impact of assessment will be re-visited within the discussion of learning styles in a section 2.7. One of the many factors contributing to impact is the

consequence of assessment (Cilliers et al., 2010). Consequences can include student feedback to improve performance or decisions around progression or graduation from a course. The intended purpose and associated consequences of assessment have an impact on students' learning behaviour and consequently there is an impact on curriculum alignment. The following section will therefore discuss the purpose and potential consequences of both formative and summative assessment.

2.6.2: The role of formative and summative assessment

Summative assessments are traditionally used at the end of a period of study to make pass/fail decisions. They are often referred to as high stakes examinations as the consequences of failure can be the inability to progress or graduate from a course. At the other end of the assessment spectrum formative assessments are designed to provide feedback to students (and staff) on their progress. Accordingly they are referred to as low stakes where poor performance generates feedback on how to improve but the student's future on the course is not affected.

It is important to clearly define the purpose of the assessment within any strategy (Fuentealba, 2011, Hardie, 2008) as this will influence the format used. Methods favoured by universities in a summative context are often objective, reliable and legally defensible. Conversely, methods used in a formative context are often subjective but provide the student with effective feedback (Hardie, 2008).

Formative assessment that provides effective feedback is essential for the development of competence (Carraccio et al., 2002) and also for progression to expertise through deliberate practice (Ericsson, 2007).

Feedback on performance promotes reflective practice and can provide students with the motivation to learn and improve (Fuentealba, 2011). However to fulfil this potential, feedback must be effective which requires an on going and timely approach, feedback should be specific and actionable and generated as a result of discussion between the student and teacher (Norcini et al., 2011, Nicol and Macfarlane-Dick, 2006).

Generation of effective feedback has received much attention within educational research. Results from the National Student Survey (Mori, 2013) suggest that veterinary and medical students perceive feedback on their academic performance as unsatisfactory. This has led to research into provision of effective feedback in the veterinary context. For example the use of audio feedback (Rhind et al. 2013), the use of simulation to provide feedback (Ballie et al. 2005), feedback on communication skills (Adams and Kurtz, 2012) and enhancing feedback within the clinical workplace (Warman et al. 2014).

Gibbs and Simpson (2004) state the importance of ongoing feedback provided regularly on small chunks of course content. Within an outcomes-based curriculum some responsibility lies with the students to seek regular feedback in order for them to take responsibility for their own progression (Davis, 2003, Harden, 1999). Feedback-seeking behaviour has been observed within the clinical work-place but can be deterred due to the hierarchical relationship between the student and the teacher (Pelgrim and Kramer, 2013). To enhance feedback seeking behaviour, feedback should focus on student performance rather than on personal characteristics (Gibbs and Simpson 2004). However, the relationship

between the trainer and trainee within the workplace is complex and has an inevitable impact on assessment and the feedback provided (Govaerts et al, 2007).

Both the content and delivery of feedback are important for effective learning (Gibbs and Simpson 2004, Pelgrim et al, 2012). Whilst perception of credible and constructive feedback varies with culture and context (Watling et al, 2013) some basic principles can be consistently applied. Time should be planned for discussion and feedback following observation; feedback should take the form of a dialogue; positive feedback should be used to increase trainee confidence; clear goals should be set and students should be given time and opportunity to process and subsequently act on their feedback (Pelgrim et al 2012, Nicol and Macfarlane-Dick, 2006, Pelgrim and Kramer, 2013, Gibbs and Simpson 2004, Govaerts et al, 2007).

Effective feedback is clearly integral to the success of formative assessment. Considering more broadly the utility of effective formative assessments acceptability is essential if both staff and students are to engage with the process and feasibility is important if formative assessment is to become an on going part of the learning process. To achieve maximum educational impact and student motivation validity is key, however, reliability is likely to be less important in a formative context (Norcini et al., 2011).

Traditionally summative assessments offer little individual feedback and can drive the student to adopt a surface or strategic approach to learning. This effect is described by Cilliers et al. (2010) in preparation for

summative exams, when medical students reported memorising lists rather than gaining insight into a topic, as they believed the facts to be imperative to exam success. Although high stakes assessments often result in a surface approach to learning and students place more value on the formative purpose of assessment (Duffield and Spencer, 2002) summative assessments are essential for purposes such as selection and graduation. Furthermore if consideration is given to the alignment of high stakes assessments with the ILOs and teaching philosophy any negative effects on student learning can be minimised (Swanwick, 2010, p.260).

The descriptions of formative and summative assessments provide a greatly polarised view of assessment purpose. Often a combined approach includes a high stakes assessment used for summative purposes, but also involves generation of feedback for improvement and re-assessment as necessary (Dent and Harden, 2013, p.303). The assessment methods within this study include those that are purely formative or summative in nature as well as those with a combined purpose.

The following section will look at the assessment formats used within this thesis in more detail. The purpose and utility of each format will be considered in the assessment of clinical competence.

2.6.3: Assessing clinical competence in veterinary students

Hardie (2008) surveyed 24 veterinary schools across North America and the UK to determine the current methods used for assessing clinical competence. The most frequently used method was a global rating of clinical rotation performance. MCQ examinations and direct observation of technical skills were also used by some colleges and will be discussed in

this section along with the script concordance test (SCT), as these three formats are central to the research in this thesis.

During final year students also complete a professional portfolio, however this has not been included in the research within this thesis. A portfolio is a versatile assessment and is used in a variety of different contexts. To this end it is not an assessment format per se, but a collection of pieces of work, usually selected by the student, to demonstrate achievement and facilitate instruction (Paulson et al., 1991). The SVMS portfolio is an innovative format designed to assess professionalism, rather than clinical knowledge or skills (Mossop and Senior, 2008). The introduction of professionalism into veterinary curricula is currently at an embryonic stage, although there is a growing body of research around professionalism in both medical and veterinary contexts (Mossop and Cobb, 2013, Roder et al., 2012, Cruess and Cruess, 2006). Assessment of professionalism is challenging (Hodges et al., 2011) and consequently the structure of the SVMS portfolio has evolved since the school opened in 2006. In summary, the purpose of SVMS portfolio is solely to assess professionalism, there is a lack of assessment of professional portfolios in other veterinary schools for comparison and the students have experienced several changes to the current SVMS format. Therefore, it was decided not to include the educational impact of the portfolio in this thesis. However, role of the portfolio as an assessment of veterinary professionalism will be a focus for research in the future.

2.6.3.1: Multiple choice questions (MCQs)

First described by Frederick Kelly in 1914 (Swanwick, 2010, p.217) MCQ exams have become a regular component of assessment strategies in medical and veterinary education. MCQs exist in different forms, the most notable and commonly used is the A-type, in which several possible answers are provided to a question and the correct option is selected. Within the SVMS assessment strategy, MCQs are used to test factual recall, mainly in years 1 to 3 of the course, and also to test higher order learning objectives by utilising a clinical vignette to generate the question, as described by Case and Swanson (1998).

MCQs have several advantages over other written assessment formats such as short answer or essay questions. A broad sample of knowledge can be tested within the assessment time; they provide reliable scores; MCQs are relatively easy to produce and administer and marking is quick with minimal use of staff time, especially with optical or computer marking (Dent and Harden, 2013, p.329, Swanwick, 2010, p.44). Testing a large sample of the course LOs results in a more effective blueprint therefore increasing alignment and reducing the influence of the assessed curriculum (Verhoeven et al., 1999) and additionally reduces the effect of case specificity (Van Der Vleuten, 1996, Case and Swanson, 1998).

But there are limitations to the MCQ exam. Clearly in assessment of clinical competence, the MCQ can only assess at the level of 'knows' and 'knows how'. Although computer marking reduces assessor variation, careful construction of MCQs is essential to avoid item flaws that can reduce reliability (Case and Swanson, 1998) and without adequate

training there is a tendency for question writers to target LOs that require recall of declarative knowledge at the expense of assessing functioning knowledge, thus challenging the validity of the test (Swanwick, 2010, p.44, Biggs, 1996). Case and Swanson (1998) describe two groups of item writing flaws that increase cueing effects: testwise flaws and irrelevant difficulty. Testwise flaws allow students who adopt a strategic approach to answering questions to obtain a higher score, which is not a true reflection of their understanding of the topic. Irrelevant difficulty refers to those MCQs where the question is overly complex and therefore tests some ability other than the trait it was designed to test. Staff must be trained in item writing to avoid these issues that challenge the concept of constructive alignment (Case and Swanson, 1998).

Larsen et al. (2008) propose that short answer assessment formats that require effortful retrieval of information result in a greater retention of clinical knowledge compared to MCQs that rely solely on recognition. However, the MCQ format has been established as a progress test in some institutions to evaluate progression through problem-based learning (PBL) curricula (Blake et al., 1996, Boshuizen et al., 1997). Performance has been shown to improve as students advance through the course and results from later years can be used to predict performance on medical licensure exams (Blake et al., 1996). Progress tests have also been shown to have high correlations with assessment of clinical reasoning (Boshuizen et al., 1997). These findings suggest that the MCQ exam, when used in an appropriate context can contribute more to the assessment strategy than recognition of facts and increasing the likelihood of a strategic approach to learning.

The MCQ exam has also been criticised because candidates have a relatively high chance of guessing the correct answer when presented with 4 or 5 options, therefore a correction for guessing is often necessary (Schuwirth et al., 1996). Downing (2003a) however, explains that concerns over guessing are unfounded. He argues that medical students (we assume that veterinary students are likely to be similar) rarely randomly guess. He proposes that students are more likely to make an informed guess. Furthermore if they were to randomly guess it is extremely unlikely that this approach would lead to a high test score on an MCQ exam with 100 questions or more. Downing concludes that a correction for guessing is therefore not necessary in the context of medical examinations.

It would be a logical assumption that increasing the number of options for an MCQ item would minimise the effects of random guessing. EMQs (also known as R-type questions) were developed by Case and Swanson (1998) originally for the assessment of clinical problems, their use has now been extended to other areas for example basic science. With up to 26 options used in a question, EMQs have been used to prevent random guessing and they have been shown to have good reliability and construct validity (Bhakta et al., 2005). However, despite creating a list of homogenous items, the context of the scenario often results in some options becoming automatically redundant. Furthermore increased options requires increased time to read the question, thus fewer questions can be set in the available testing time and this therefore results in reduced reliability of the test (Swanson et al., 2005). The optimal number of options within an MCQ is controversial. Schuwirth and Van Der Vleuten (2004) state that

increasing the number of options is generally associated with increased reliability, but only if all options are plausible. For example, an MCQ with three plausible options is just as good as a question with five options, where two non-functional distractors are never selected (Schuwirth and Van Der Vleuten, 2004).

There is evidence from veterinary education to support the use of EMQs to assess clinical reasoning (Tomlin et al., 2008a, 2008b). The results from two studies at the Royal Veterinary College demonstrated that students and faculty both found this method of assessment acceptable although concerns were raised from both groups that the EMQ format encouraged pattern recognition that may not be appropriate for undergraduate students. Whilst the authors describe the EMQ as a valid and reliable assessment of clinical reasoning, these findings are based on the perceptions and performance of one cohort of veterinary students following a formative EMQ paper, which was reported to have low reliability. Further evidence is therefore required to support the use of EMQs as an assessment of clinical reasoning in a veterinary context.

Other versions of the MCQ that have been used for decades in higher education are the True/False questions, also known as X-type questions. There use is no longer recommended as there is sufficient evidence to suggest that these items are often ambiguous due to context. To prevent ambiguity options must be written as completely true or completely false statements which results in very fact based questions, which require recall with no application of knowledge from the student (Case and Swanson, 1998).

In summary, carefully constructed MCQs have their place within any assessment strategy as a feasible method of assessing a broad sample of LOs. But MCQs also have their limitations and therefore should be used alongside alternative assessments of clinical competence.

2.6.3.2: Script concordance test

The script concordance test (SCT) was first described by Charlin et al. (2000a) as an assessment tool designed to test clinical reasoning in authentic but ill-defined scenarios. Clinical reasoning can be defined as the cognitive skills involved in patient evaluation and management (Barrows and Tamblyn, 1980) and it is accepted as an essential component of clinical competence. It is therefore not surprising that the development and assessment of clinical reasoning has provided a focus for much discussion and research in healthcare education. This section will discuss the principles of design and implementation of the SCT; it is however beyond the scope of this thesis to review the literature relating to the proposed theories for the development of clinical reasoning and its assessment.

Script theory is closely related to the hypothetico-deductive model of clinical reasoning (Barrows and Tamblyn, 1980, Coderre et al., 2003). Illness scripts describe the way in which clinicians organise their knowledge of clinical encounters, based on previous experience and case exposure (Charlin et al., 2000b, Charlin et al., 2007). When a new patient is presented relevant scripts are activated, which has been compared to the process of hypothesis generation (Charlin et al., 2000b). Script processing follows script activation in which the clinician compares the

script with case information, analogous to hypothesis testing, allowing decisions to be made around diagnosis and case management.

The SCT assesses the ability of the candidate to interpret data relating to a clinical problem. A short case description is followed by a hypothesis regarding the diagnosis, further investigation or management of the patient. A piece of new information is then provided and the candidate is asked to make a judgement about the likelihood of the hypothesis based on this new information (Fournier et al., 2008, Dory et al., 2012). Figure 2.6 provides an example SCT question to illustrate the format.

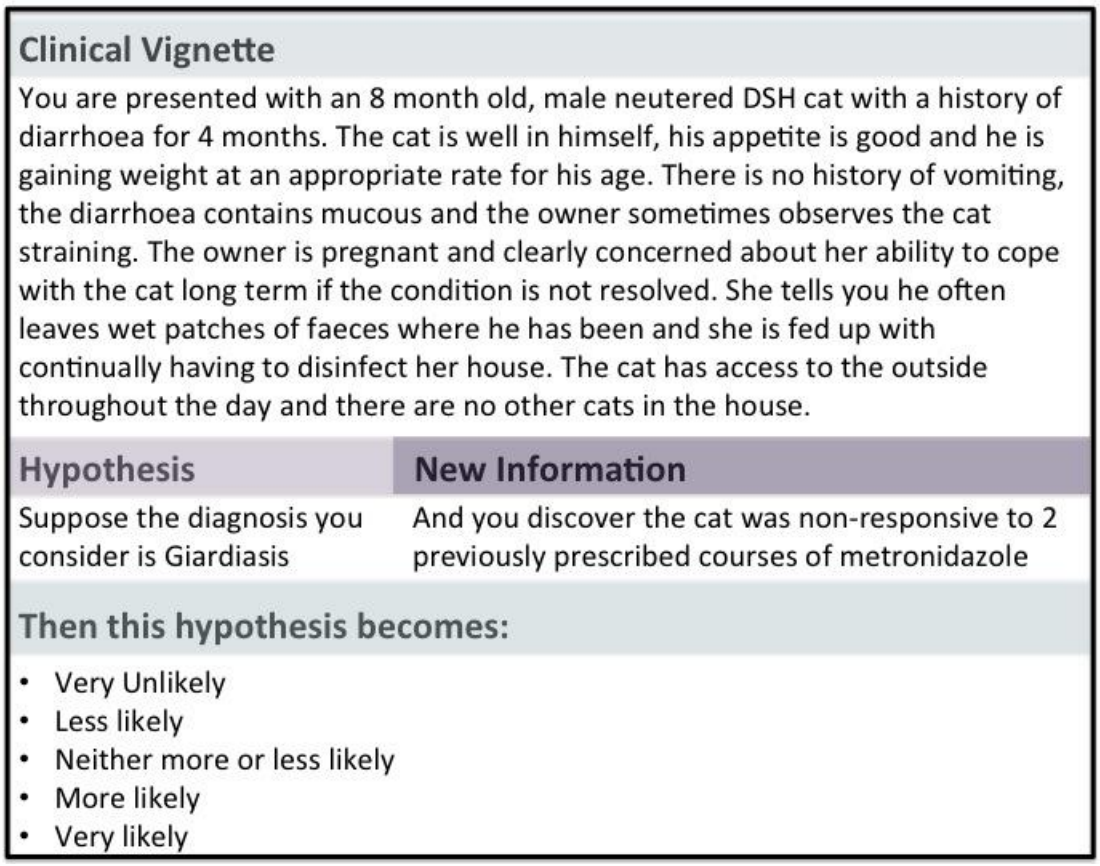

Figure 2.6: An example SCT question.
The clinical vignette is read first, followed by the hypothesis and then the new information. A decision is made on the likelihood of the hypothesis based on the new information.

The candidates' responses are then compared to those of a panel of experts and marks are awarded for the degree of concordance. In contrast to many other MCQ formats there is no single best answer. In the traditional scoring method, responses are weighted against the modal answer and although alternative methods of scoring have been investigated they have not been found to have significant benefits over the traditional method (Ramaekers et al., 2010).

The SCT has been used more widely in postgraduate assessment (Carrière et al., 2009, Brailovsky et al., 2001, Sibert et al., 2002, Lubarsky et al., 2009) but also in undergraduate assessment (Brailovsky et al., 2001, Duggan and Charlin, 2012) including the assessment of basic sciences in

pre-clinical medical students (Humbert et al., 2011) and as a progress test in veterinary students (Ramaekers et al., 2010). There is evidence to support the use of the SCT as an assessment of data interpretation (Lubarsky et al., 2011). Studies exploring the relationship between scores from the SCT and fact-based MCQ assessments, identified weak correlations suggesting the SCT assesses a different construct other than the recall of factual knowledge (Fournier et al., 2006, Collard et al., 2009). Further evidence for the validity of the SCT is provided by studies that have shown that test scores increase with increasing clinical experience (Carrière et al., 2009, Brailovsky et al., 2001, Sibert et al., 2002). Reliability studies have shown the SCT method to have acceptable alpha values, between 0.7 and 0.9, when a panel size of at least 10-15 experts is used (Carrière et al., 2009, Sibert et al., 2002, Lubarsky et al., 2009, Fournier et al., 2006, Gagnon et al., 2005, Meterissian et al., 2007).

Although there is evidence to support the SCT as an assessment of clinical reasoning, it should be emphasised that there are limitations to the method. One obvious limitation is the lack of a patient and in the context of veterinary medicine the lack of both a patient and a client. Askew et al. (2012) highlight the importance of context on the reliability and validity and therefore an individual SCT examination should be evaluated in the context of the environment in which it is delivered. They also alert us to the danger of 'atomising the construct of clinical reasoning' within a SCT; clinical reasoning involves processing all aspects of case information and simply focussing on a small part of this may not represent true clinical reasoning as it occurs in practice.

Lineberry et al. (2013) recently challenged the validity of the SCT concluding that the traditional method of aggregate scoring and variation in responses from the expert panel are significant flaws in the current SCT model. Lubarsky et al. (2013) responded to this critique arguing that variability due to the expert panel is essential to the discriminatory power of the SCT.

As a relatively new assessment format, little is known of the educational impact of the SCT and its effects on student learning behaviour (Lubarsky et al., 2011). Hornos et al. (2013) describe the successful use of the SCT format to provide online continuing professional development to physicians to promote reflective practice. At an undergraduate level, Larsen et al. (2008) state that novel formats, namely the SCT, should be investigated as assessment for learning strategies.

Whilst the SCT may not provide all the answers in the search for a valid assessment of clinical reasoning it shares many of the advantages of other MCQ formats. For example, the short completion time reduces the effects of case specificity and marking is less onerous compared to short answer formats such as modified essay questions. However, feasibility can be an issue regarding recruitment of the expert panel and review of their responses (Gagnon et al., 2005) and like other MCQ formats, the SCT can only assess to the 'knows how' level of Miller's pyramid. Assessment at the level of 'shows how' and 'does' requires performance assessment and will be considered in the next section.

2.6.3.3: Workplace based assessment

The introduction of workplace-based assessment (WPBA) into many healthcare courses has resulted from the concern that students are rarely observed and given feedback on their performance in clinical practice. A large component of clinical training occurs in the workplace and robust WPBA is therefore an essential element of any assessment strategy (Holmboe et al., 2010). Whilst simulation provides a safe environment for assessment and feedback in the early stages of the course, authentic assessment within clinical practice must be included in competency assessment (Carraccio et al., 2002). The workplace provides an excellent learning environment and assessment in this context is often perceived by staff and students to have high face validity. Historically global judgements have been made on students' performance during clinical placements (Hardie, 2008) however with little structure or standardisation these have proved to be unreliable (Van Der Vleuten, 1996).

Although several methods of formative assessment have been developed with the potential to provide contextual feedback on individual performance (Rudolph et al., 2008, Wilkinson et al., 2008, Fernando et al., 2008), Norcini and Burch (2007) state that assessment in the setting of clinical training is not well developed and highlight some of the challenges faced in the process including reliability, relationships and feasibility. Implementation of a number of low stakes assessments, where less emphasis is placed on achieving a 'pass mark' and the purpose is formative, potentially enables students to identify areas of weakness, improve their performance and encourages a deeper approach (Nicol and Macfarlane-Dick, 2006).

Previous studies have looked at the validity and reliability of the various tools designed to assess students in clinical practice. Prescott-Clements et al. (2008) described the use of the Longitudinal Evaluation of Performance (LEP) to assess Dental students in Scotland, its use has been successful in contributing to summative decisions regarding student competence. A study across hospitals in the UK concluded that WPBA formats, including the mini-clinical evaluation exercise (mini-CEX), directly observed procedural skills (DOPS) and multi-source feedback (MSF), were both feasible to implement and reliable in differentiating between performance in post-graduate doctors (Wilkinson et al., 2008). Other studies have expressed concerns over the number of WPBA encounters required to achieve acceptable reliability for summative purposes, which questions the feasibility of WPBA in this context (Murphy et al., 2009, Alves de Lima et al., 2007).

Returning to the overall utility of WPBA, few studies have explored the educational impact of these assessment formats and the influence they have on experiential learning. A study in Copenhagen, evaluating the educational impact of an in-training assessment program for postgraduate students in anaesthesia, (Ringsted et al., 2004) concluded that the program made objectives clear and encouraged dialogue between supervisors and students. Signing of checklists, however, was seen as a hoop jumping exercise but where educational benefit was perceived amongst discussion and reflection the students gained confidence. Al Kadri et al. (2011) identified assessment as one of three factors that influence medical students' study strategies during clinical rotations. A subsequent study describes the effects of WPBA on study approach (Al-Kadri et al.,

2013). The authors conclude that WPBA encourages a deep approach to learning, however they identify contextual factors that result in a more strategic approach namely the influence of the supervisor, excessive negative feedback and a summative context.

Disadvantages of assessing performance during clinical placements have been identified. These include limited opportunities for students to complete necessary skills, often leading to a rush towards the end of the rotation period (Hardie, 2008). WPBA places additional demands on faculty time (Al Kadri et al., 2011) and further work is needed to identify ways to ensure their observations are accurate and their feedback to students is effective (Holmboe et al., 2010). A further concern raised by faculty utilising observation of skills during rotations was whether a single demonstration of a skill ensured clinical competency over time. This is an important consideration as students may perform differently under observation and if the skill is not regularly used may be forgotten (Hardie, 2008). Within veterinary practice the species in which the WPBA is undertaken should also be considered. Just as clinical competency maybe time and discipline dependant, species areas are likely to be an additional factor to consider in veterinary WPBA.

With no universal approach to performance assessment in the workplace evaluation of the utility of WPBA is limited. Holmboe et al. (2010) call for a move away from multiple 'home grown' assessment formats and the development of a core set of assessment tools. However, this 'home grown' approach may be inevitable to meet acceptability and feasibility requirements in individual institutes and clinical contexts.

Development of an effective assessment strategy is complex with numerous challenges in the assessment of clinical competence. However, if constructive alignment is to be achieved, assessment cannot be considered in isolation, it must be an integral part of the wider curriculum. ILOs can be measured indirectly, however, direct assessment of ILOs is essential for student feedback, course evaluation and university progression. It is widely accepted that direct assessment of student performance has a major influence on student learning behaviour and therefore has an impact on student learning outcomes. Observation of student learning behaviour is therefore one of the ways in which CA can be evaluated within the curriculum. The next section provides a review of learning behaviour and the factors that affect it.

2.7: Learning behaviour

A vast amount of research and proposed theory exists regarding learning behaviour. In addition to educational psychology, research on learning styles has emerged from a variety of settings including medical and healthcare education, management, industry and vocational training (Cassidy 2004). This has resulted in numerous definitions, theories and measures of learning behaviour; it is not possible to discuss all proposed models of learning style in this section. An overview of the important concepts to be considered regarding learning styles in veterinary education will be followed by a more in depth discussion on the approach to student learning described by Biggs (1987a) as this model is used to investigate learning styles in this thesis.

Whilst it is generally accepted that the approach to a learning opportunity has an impact on the achievement of learning outcomes, the lack of consistent definitions makes any discussion regarding learning styles challenging (Cassidy 2004). Learning style and cognitive style are often used interchangeably and refer to an individual's typical way of problem solving, thinking and remembering (Riding and Cheema, 1991). Whereas learning preference is used to describe preferred methods of delivery and environment and learning strategy describes an individual's approach to a task. Both learning preference and strategy are heavily context dependent (Cassidy 2004).

Learning style is a complex entity and incorporates aspects of an individual's personality, methods of information processing, social interaction and environmental factors. A layer-like or 'onion' model has been used to describe learning style which consists of four components or 'layers' (Curry, 1983, Curry, 1987). The innermost layer describes cognitive personality style, followed by information processing, social interaction and the outermost layer represents instructional preference.

There is controversy over whether learning styles are a stable trait or whether they can be adapted and change with time. In Curry's onion model (Curry, 1987) the inner layers are described as more stable innate traits compared to the outer layers which are more susceptible to change and context dependant. According to Biggs (1987a), learning style is a consequence of several component factors, he refers to presage factors which can be personal or situational. Personal factors such as prior knowledge, experience and personality cannot be changed whereas the

course structure, teaching and assessment tasks are situational factors which change and students adapt their learning strategies accordingly. It would seem therefore that certain aspects of learning style are more stable than others. Furthermore, the concepts of meta-learning (being aware of one's own learning and having the ability to adapt to different contexts) and meta-cognition (reflection on one's own cognitive processes and the ability to evaluate and regulate them) also support the theory that learning styles can be adapted and are not an entirely stable trait (Biggs, 1987a).

Kolb's experiential learning model (Kolb, 1984) describes learning as a developmental process, also suggesting that learning style is a fluid entity. His model, shown in figure 2.7, is often referred to in healthcare education because it is easily related to learning in a clinical workplace. Development of the Learning Styles Inventory (LSI) (Kolb, 1976) enabled measurement of learning styles, specifically a preference for action or reflection and experience or thinking.

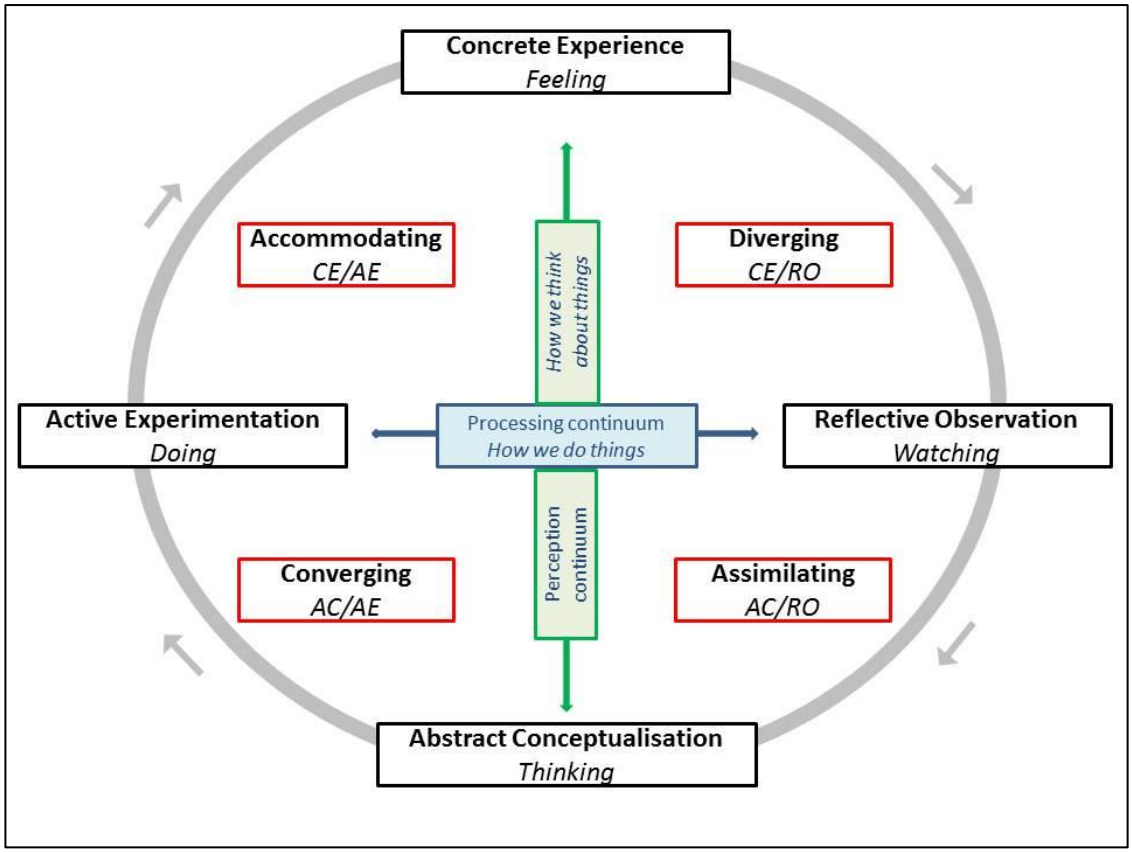

Figure 2.7: Kolb's Experiential Learning Model.
Adapted from Kolb (1984) Experiential Learning: experience as the source of learning and development. CE, concrete experience; AE, active experimentation; RO, reflective observation; AC, abstract conceptualisation.

Kolb's experiential learning model and the LSI were later used by Honey and Mumford to develop their learning styles questionnaire which has been widely used in management training (Honey and Mumford, 1992).

Marton and Säljö (1976) described surface and deep levels of processing in their study of Swedish university students. Based on this work Entwistle et al. (1979) developed the approaches to study inventory (ASI) which has been used extensively in educational research. The ASI identifies learners as having one of four styles: deep, surface, strategic and apathetic. The work of Marton and Säljö and Entwistle et al. was developed further by Biggs (Biggs, 1987a). He describes the student approach to learning as either deep, surface or achieving; each approach

being characterised by a motivation and a learning strategy, summarized in (Table 2.2). According to Biggs, students who adopt a deep approach are intrinsically motivated about their subject and apply learning strategies that enable them to relate prior knowledge and different topics to increase their understanding. These are usually high achieving students sought after by higher education institutes. Students with a competitive nature adopt an achieving approach, they utilise a highly organised strategy to achieve the highest marks. They may include elements of the deep and surface approaches to achieve, but lack the intrinsic motivation and sometimes understanding demonstrated by deep learners. Finally the surface approach describes those students whose motivation is purely to complete the course without failure with a lack of passion for the subject. The surface strategy involves memorising and rote learning of concepts that are most likely to be examined on.

Approach	Motivation	Strategy
Deep	Interest in the subject resulting in intrinsic motivation to learn.	Develop understanding of the subject, linking ideas and concepts.
Surface	Fear of failure, motivated to complete the minimum amount of work to pass.	Reproduction for high stakes assessment, involves rote learning.
Achieving	To achieve the highest grades possible, motivated by competition with their peers.	Organisation of work for academic success. May involve elements of both deep and surface strategies.

Table 2.2: Summary of the differences in motivations and learning strategies between the deep, surface and achieving approach to learning as described by Biggs (1987).

Previous studies support the idea that approach to learning is not a fixed entity and that study habits can change according to context. For example, different learning environments (Biggs, 1987b, McManus et al., 1998, Kember et al., 1997) assessment formats (Newble and Jaeger, 1983, Scouller, 1998, Leung et al., 2008, Tang, 1994) and year of study (Biggs, 1987, Donnon and Hecker, 2010) can influence learning behaviour.

A change in study approach with progression through a course is likely to be driven by the learning environment, including both teaching and assessment. Biggs (1987b) showed a decline in a deep approach and an increase in the surface approach of science students moving from first

year to final year. Similarly Donnon and Hecker (2010) describe a shift from a deep to a surface approach to learning in Health Science students during their final year of study. In professional healthcare courses graduates are expected to demonstrate clinical competence that requires a contextualised understanding of a topic; the consequences of a superficial approach to study could therefore be detrimental to both performance in the professional environment and also to patient care. Cilliers et al (2010) interviewed medical students who describe the tension they experience between studying to pass exams and studying to become a good clinician. As they progressed towards student internship their contribution to patient care became a more prominent factor in their learning whereas earlier in the course they were prepared to sacrifice this vocationally motivated learning in order to reduce stress levels and pass exams.

The impact of assessment on the learning process has already been touched upon within this literature review and it is apparent that multiple assessment-related factors impact learning behaviour (Cilliers et al., 2010, Al-Kadri et al., 2012). Assessment backwash as described by Tang (1994) results in learning being driven by the perceived demands of assessment tasks rather than the curriculum. Previous experience of assessments may influence study habits; a study conducted at the University of Sydney (Scouller, 1998) describes how students adopted a deep approach to assignment essays perceiving this format as requiring higher levels of cognitive processing. The students approach to learning shifted depending on exam format, they adopted a more surface approach for MCQ exams. In the same study, learning approach was compared with

performance, a positive correlation was demonstrated between deep approach and the essay assignment but there was a negative correlation between deep approach and MCQ grades. This suggests that students who are intrinsically motivated to learn and show a preference for deep learning strategies could be disadvantaged by the assessment format, in this case the MCQ exam. Other studies have explored the relationship between learning approach and academic performance, positive correlations have been found between deep and achieving approaches to learning and exam scores (McManus et al., 1999, McManus et al., 1998, Donnon and Hecker, 2010) and a surface approach to learning has been shown to correlate negatively with exam performance (Leung et al., 2008, McManus et al., 1999).

Following a review of the literature, Al-Kadri et al. (2012) emphasize the importance of assessment function to study strategy. They conclude that formative assessment is more likely associated with a deep approach compared to summative assessments that often elicit surface strategies. The use of low stakes assessment to inform progress has been described as *assessment for learning* (AFL). This concept is not a novel one and its use within the classroom has been encouraged for many years (Black and Wiliam, 1999); more recently AFL has been given increasing importance in higher education, however further evidence for effective implementation of AFL theory in assessment programs is needed (Schuwirth and Van Der Vleuten, 2011a).

Gibbs and Simpson (2004) propose a set of conditions which support the concept of AFL. Firstly the provision of sufficient assessment tasks is

required to drive student learning. Furthermore assessment tasks must allow students to engage with the most important aspects of the course and result in productive learning. Finally the assessment must result in the production of effective and appropriate student feedback which is then acted upon to enhance student performance.

In the context of the clinical workplace, Al-Kadri et al. (2013) provide evidence for the use of WPBA as AFL in their qualitative study of medical students in Saudi Arabia. The students reported that WPBA promoted deep learning approaches when positive feedback was provided at the time of the assessment. They also valued peer assessment and feedback within the workplace. In contrast, their supervisors placed value on WPBA when used summatively, which was seen to produce an achieving effect on learning, dependant on context and supervisor. These conflicting perceptions of the purpose of WPBA provide evidence of some of the challenges of successful implementation of AFL within assessment strategies. These findings are aligned to those of Bok et al. (2013) who conclude that a transformation of the clinical learning environment is required, if WPBA is to be considered a teaching and learning opportunity, with a focus on qualitative feedback to enhance AFL.

There is limited evidence to support specific assessment tools as AFL within veterinary education. However, Giuliodori et al. (2008) report the use of collaborative group testing to this effect. Student performance increased with collaborative group testing, but students also reported increased levels of confidence, increased opportunities for discussion and a more constructive classroom environment associated with this

assessment format. These findings support the use of collaborative testing as AFL and also concur with the findings of Bok et al. (2013) and Al-Kadri et al. (2013) that interaction with peers is important within assessment to promote effective learning.

Ramsden (1992) describes the impact of assessment on student learning, he states that as far as the students are concerned, assessment is the curriculum. It is apparent that alignment of teaching and the learning environment alone is not sufficient; to meet the requirements of CA assessment must also be aligned to the ILOs to enhance desirable learning strategies. However, the learning environment cannot be ignored as this has been shown to influence learning behaviour (Haarala-Muhonen et al., 2011). This thesis is concerned with final year veterinary students, for whom the learning environment is the clinical workplace; the next section will therefore discuss workplace-based learning.

2.8: Workplace-based learning

Experiential learning occurs as a consequence of any everyday experience or interaction, in this section we are concerned with authentic experiences in the clinical workplace. For veterinary students within the UK, the clinical workplace includes placements within university hospitals and associated practices (intramural) and those outside of the university (extramural). A number of educational theories underpin the principles of workplace-based learning (WPBL), including experiential learning, socio-cultural learning and adult learning theory. This section will discuss those relevant theories as well as some of the benefits and challenges of providing WPBL in a veterinary context.

2.8.1: Experiential learning

Experiential learning is based on the principles of constructivism in that individuals learn from their own experiences over time, transforming the way in which they perceive reality. One of the most influential theorists within this field is David Kolb. Based on the work of Dewey, Lewin and Piaget, Kolb (1984) developed his model of experiential learning shown in figure 2.7. He describes learning as a conflict or tension filled process where all successful learners complete a cycle of concrete experience followed by reflective observation, abstract conceptualisation and finally active experimentation. Kolb's model is widely used in medical education to stress the importance of student reflection in WPBL as opposed to a more traditional view where the emphasis is on the clinician as a teacher. As learning is thought of as a continual process, all students enter the workplace with some prior knowledge, therefore it is the job of the educator to modify or dispose of previous misconceptions as well as introduce new ideas (Kolb, 1984).

Kolb's theory differed from existing behavioural theories of learning and traditional approaches to education in that he described learning as a process and not based on observable outcomes. Experiential learning therefore challenges the role of learning outcomes that can result in memorization of knowledge at the expense of experience and reforming ideas.

Experiential learning has been developed and adapted to healthcare education and in a recent review Yardley et al. (2012) state three key concepts underpin experiential learning: firstly learning is situated and

cannot be separated from its context; secondly learning can be an individual or collective process and finally learning is triggered by authentic practice based experience. One of the criticisms of the work of Kolb and experiential learning is that learning is described as an internalised individual process. Yardley et al. (2012) claim that even though learning can be an individual process all experiential learning stems from social interactions.

2.8.2 Socio-cultural perspectives

Vygotsky, often considered the founder of socio-cultural learning theory, claimed that social and cultural interactions are fundamental to learning. Central to his work on social learning are the concepts of inner speech and the zone of proximal development. Inner speech describes how thoughts gain meaning only after they are transformed into language through social interaction. The zone of proximal development describes the potential additional learning that could occur with supervision (Vygotsky, 1986). These concepts demonstrate the importance of interaction and discussion with both peers and senior clinicians in applying knowledge and the development of clinical competence. According to socio-cultural learning theory, effective learning cannot occur without discussion, supervision and feedback.

Lave and Wenger (1991) used socio-cultural theories to develop the concept of communities of practice (COP). This concept describes the learner working within the practicing healthcare team where patient care and safety is of upmost importance. COPs are widely used to describe the setting for learning in the clinical workplace and enable the student to

identify role models and develop a professional identity. Wenger (1998) describes the student as a legitimate (they have a right to be there) peripheral (qualified healthcare professionals are central to patient care) participant (participation within the community is essential to learning). As they gain experience the learner moves from the periphery towards the centre of the COP.

Within veterinary education socio-cultural theories are also seen as important to WPBL. The veterinary practice has been described as a 'social, relational and discursive' environment (Scholz et al., 2013). An ethnographic study involving students from two veterinary schools within the UK concluded that learning within intramural rotations occurred through social interaction (Magnier et al., 2011). The principles of experiential learning and the socio-cultural perspectives described can be applied to any stage of education. Considering veterinary students in higher education it is also essential to appreciate the requirements of adult learning.

2.8.3 Adult learning theory

The work of Knowles on adult learning theory (1980) is closely linked to experiential learning. He proposes that adults learn best in certain environments, specifically when: learning is self-directed; they can draw on prior experience; the learning is relevant, problem centred and when internal motivation drives their learning. It has since been argued that adult learning is also enhanced when there is opportunity for collaboration (Yardley et al., 2012). Knowles received criticism for over simplifying the principles of adult learning; current thinking describes learning as a

continuum with paedagogy and andragogy at either end. However, paedagogy is not exclusive to children and andragogy to adults, there may be circumstances where adults require more supportive learning or where children learn successfully through enquiry based learning approaches (Yardley et al., 2012). This overlap between paedagogy and andragogy may be particularly evident in young adults making the transition from school to university education.

2.8.4 Benefits of WPBL

Drawing on the theories of experiential learning, adult learning and socio-cultural learning, WPBL is thought to foster deep learning approaches, encouraging reflection, discussion and relating new knowledge to prior experience (Dale et al., 2008). The consequence of real life problems in the clinical environment drives intrinsic motivation for students (Miller, 1997). Bell et al. (2009b) describe the advantages of WPBL as not only developing knowledge, skills and attitudes but it also results in confidence, motivation and a sense of belonging.

Dale et al. (2008) also claim that experiential learning forms an ideal transition from student to practitioner as students must take responsibility for their learning and development, forming the basis of lifelong learning. Finally, within veterinary curricula WPBL often provides the opportunity for elective placements that are selected by the learner. Consequently they are more likely to be intrinsically motivated about modules that are relevant to their own professional development, this is closer aligned with adult learning theory (Dale et al., 2008).

2.8.5 Challenges of WPBL

It is difficult to argue against learning through experience within the context of a professional vocational course, however, there are challenges to the successful implementation of WPBL.

Dale et al. (2008) argue that despite calls for reform to veterinary education previous attempts have failed due to a lack of alignment between new teaching practices and traditional methods of assessment. A lack of CA results in many of the benefits of experiential learning being lost due to the impact of high stakes assessment.

Some of the challenges to the ideal experiential learning environment result from the logistical problems in the clinic. For example time pressures, competing demands of patients, students, colleagues, research and a varied caseload makes teaching opportunistic and difficult to plan (Spencer, 2003). In their study of veterinary students Magnier et al. (2011) describe similar problems. In addition perceived barriers to effective WPBL included students feeling under confident and not well enough prepared for clinics, and clinicians having to prioritise clinical work and patient welfare over teaching. Scholz et al. (2013) elaborate on the diversity of veterinary practice environments with different species, financial considerations, regional and seasonal variation in caseloads all impacting student learning. In comparison to medical education the lack of public interest and government support, alongside the variable provision for new graduates in their transition to practice, all provide challenges for WPBL in veterinary education (Scholz et al., 2013).

The importance of the teacher student relationship should also not be underestimated. Opportunity for discussion with time for reflection is essential and active participation is key to experiential learning. Faced with the pressures of veterinary practice striking the balance can be problematic; teachers need to adapt their approach during and on reflection of WPBL (Magnier et al., 2014). Preparation for the clinic can enhance the student experience demonstrated by the success of the extra mural studies (EMS) driving license used by veterinary students in the UK (Bell et al., 2010). The validation of the EMS driving license involved a small number (42) of third year students from two veterinary schools within the UK. Collating feedback from greater numbers of students from all years of the veterinary course could result in further enhancement of this tool. This would be of benefit to students and practitioners supervising WPBL.

In summary, this section has reviewed some of the theory underpinning WPBL. However the theorists describe what should happen in an ideal world, according to Holmboe et al. (2010) students must complete training in clinical microsystems many of which are dysfunctional. Furthermore the learner changes as they progress through different stages of their career requiring different levels of support (Yardley et al., 2012). It is likely that of the many and varied WPBL environments within veterinary education some could also be described as 'dysfunctional clinical microsystems' failing to identify the needs of individual students and meet the requirements for effective WPBL.

Within medical education, postgraduate education is a compulsory phase that prepares the newly qualified doctor for independent practice through WPBL. It is described as a crucial phase during which responsibility for patient care progressively increases with a simultaneous decrease in supervisor support (Kennedy et al., 2005). As there is no equivalent postgraduate phase in veterinary education, the transition to practice can often be abrupt with a sudden lack of support and increased case responsibility. The following section will explore some of the challenges faced by new graduate vets and the characteristics of a smooth transition to practice.

2.9: Transition to practice

The transition from student to practising veterinary surgeon has been described as a "Make or Break" period (Gilling and Parkinson, 2009) where new graduate vets experience a steep learning curve during their first year in practice (Anon, 2008). Garrett (2009) refers to recent graduates as 'expert students' and considers that a different skill set is required for success in practice. It would therefore appear that despite a shift towards OBE and the introduction of the RCVS day one competences (RCVS, 2014), current ILOs of veterinary education are not generally aligned with the requirements of professional practice. This section will explore some of the challenges facing new graduates during this critical period and the factors that contribute to a successful transition to practice.

2.9.1: What challenges do new graduates face?

A lack of support has been identified as one of the major challenges facing new graduates in their first year in practice (Gilling and Parkinson, 2009, Heath, 2008, Garrett, 2009, Routly et al., 2002). Some employers see a sufficient level of support as a drain both in financial and personal terms (Gilling and Parkinson, 2009) and there is a difference in the levels of support considered sufficient by recent graduates and their employers. Whilst most employers recognise the need for some support, there is an expectation that graduates are proficient in a core set of skills including surgery (Hill et al., 2012). A study of recent graduates found that the majority of participants frequently or always worked unsupervised and 78% stated that they had made a clinical mistake. For some these mistakes had a profound negative effect on them personally; a lack of postgraduate training and support for newly qualified vets is likely to contribute to the mistakes made (Mellanby and Herrtage, 2004).

Both recent graduates and their employers perceive current veterinary education to be insufficient preparation for some aspects of clinical practice. Specifically recent graduates were found to be well prepared in terms of knowledge and problem solving abilities, but less well prepared in terms of practical skills and communication with clients (Gilling and Parkinson, 2009, Anon, 2008).

Many graduates lack confidence in their abilities and therefore seek employment with high levels of support or internships. This is attributed in part to the broad content of the veterinary program with little of the content covered in enough detail to instil confidence (Lofstedt, 2003).

Furthermore, lack of case responsibility as a student contributes to some graduates being under confident in their ability to work independently (Garrett, 2009).

Similar factors are identified by Tomlin et al. (2010); they report a lack of self-confidence, particularly amongst female students when considering the transition to practice. Although students had realistic expectations of the profession, making mistakes, case responsibility and remembering the facts were identified as major concerns (Tomlin et al., 2010). Females were found to have higher expectations of themselves in terms of success and therefore may be more prone to some of the difficulties faced by new graduates (Kogan et al., 2004). This could result in an increased burden for employers considering the current demographic within the student and recent graduate populations (Robinson, 2013).

Finally, aside from the challenges of clinical practice many new graduates find themselves socially and geographically isolated, separated from the well-established network of peer support and friendships they have been used to during their university education (Garrett, 2009).

2.9.2: What makes a successful transition to practice?

Appropriate professional support is paramount to prevent feelings of isolation and depression amongst graduates. In addition, increased support with a formalised review programme may delay the decision to change jobs, leave clinical practice or the veterinary profession completely (Gilling and Parkinson, 2009, Anon, 2008, Routly et al., 2002). To ensure adequate preparation for practice, client communication skills and increased exposure to routine cases were identified by employers as areas

for improvement within veterinary education (Routly et al., 2002). The importance of EMS has been emphasized in preparing students for the workplace with a call from the profession for stricter regulation of EMS and more integration of EMS providers with the universities (Anon, 2008).

To ensure a successful transition to practice, several studies have identified important attributes of newly qualified veterinary surgeons (Doucet and Vrins, 2009, Rhind et al., 2011, Bok et al., 2011, Greenfield et al., 2004, Heath and Mills, 2000, Walsh et al., 2001). A common finding is that knowledge is rated as less important than many other attributes such as communication, surgical and clinical skills. Rhind et al. (2011) found that final year students placed more importance on knowledge based attributes than recent graduates who valued generic attributes such as integrity and compassion higher than the students. Client communication skills have been identified as essential in several contexts (Rhind et al., 2011, Schull et al., 2012, Mellanby et al., 2011, Bonvicini, 2010) and should therefore be an essential component in veterinary curricula to ensure a smooth transition.

To date, suggestions for improving the transition to practice are based mainly on the perceptions of new graduates and their employers. Providing evidence for the impact of a curricular intervention or the relationship between undergraduate attainment and performance in veterinary practice is challenging. In two consecutive studies, Matthew et al (2011, 2012) used phenomenography to demonstrate a relationship between veterinary students' conception of clinics and their approach to learning in their final year with their performance during clinic-based

learning and their approach to practice as new graduates. They found that deep learners with cohesive conceptions have higher attainment and are more likely to show a reflective and relational approach to practice.

More evidence of the relationship between undergraduate attainment and performance post graduation can be found within medical education. Tamblyn et al. (2002) found positive relationships between licensure examination scores and practice performance, defined by measuring several patient outcomes. Following a systematic review of the literature, medical school examinations were found to have mild to moderate correlations with practice performance (Hamdy et al., 2006). However, gaining access to patient data in private veterinary practice combined with a lack of compulsory postgraduate training for veterinary surgeons poses a significant challenge for similar studies of predictive validity of undergraduate assessment in a veterinary context.

2.10: Summary of Chapter Two

This chapter has provided a review of the relevant literature relating to OBE, assessment of clinical competence, student learning behaviour and the transition from clinical workplace based learning to clinical practice. To achieve an effective outcome based approach to veterinary education, teaching, learning and assessment methods must be aligned with appropriate learning outcomes for a new graduate veterinary surgeon. As a new school, the SVMS has had the opportunity to develop a novel, student centred curriculum including an appropriately integrated assessment strategy. How prepared a new graduate feels for work as a veterinary surgeon will be influenced by a range of both internal and

external factors. However fostering an appropriate approach to study is essential for students to achieve the intended learning outcomes of the course. Further insight into the achievement of the ILOs will be developed during this research through a deeper understanding of students' learning behaviour in their final year. Using constructive alignment as a conceptual framework, this study aims to investigate the impact of the assessment strategy on students learning behaviour in their final year at the SVMS and in their transition to practice. To address this aim, the following research questions based on the review and the experience of working closely with the students at SVMS have been posed:

1. What are the intended learning outcomes of the current veterinary medicine course, based on stakeholder opinion?

2. Do teaching, learning and assessment prepare students for the demands of clinical practice?

3. What is the impact of assessment methods, used in the final year of study in veterinary medicine, on learning behaviour?

4. What is the perception of final year students and employers of new graduates of the requirements for a successful transition to practice?

Chapter 3: Research design

This chapter will provide a discussion of mixed methods research and the justification for its use in this thesis, followed by a brief overview of each of the research methods used. Details of the methods for each study will be provided in a methods section in the relevant chapters. Finally details of ethical approval are provided.

3.1: Mixed methods research

Traditionally researchers have adopted either a quantitative or a qualitative approach to research. These contrasting approaches were considered as opposing and separate entities that should not be combined within any research strategy (Johnson and Onwuegbuzie, 2004).

Within the quantitative paradigm a positivist philosophy exists where objectivity is central to the research. The researcher must remain impartial, avoiding bias to make independent objective measurements. Quantitative research strategies employ traditional scientific methods, are usually hypothesis driven and generate numerical data for statistical analysis (Creswell, 2013). However, this purist approach has come under criticism for disregarding the fact that elements of quantitative research are often subjective for example, selecting research subjects, methods, and interpreting results (Johnson and Onwuegbuzie, 2004).

In contrast the qualitative paradigm places emphasis on the researcher to interpret their experience and observations. Advocates of qualitative research uphold the view that conclusions drawn can never be entirely objective and context free (Johnson and Onwuegbuzie, 2004, Creswell,

2013). Described by Pope and Mays (2008) as the way in which people make sense of society and the world they live in, qualitative research aims to provide explanations for social phenomena through studying people in their natural setting. However, the qualitative approach has also received criticism, especially within healthcare settings where research has traditionally been based on scientific method (Pope and Mays, 2008). Critics have labelled interpretative research as 'unscientific' and argue that conclusions based on the observations and opinions of one individual researcher cannot be valid (Johnson and Onwuegbuzie, 2004, Pope and Mays, 2008).

Mixed methods research involves combining both quantitative and qualitative components within a single study (Pope and Mays, 2008). Although there are clear tensions between the values and methods involved in both qualitative and quantitative research, Lingard et al. (2008) support a mixed methods approach which can generate new insights into complex research problems. Pragmatism places value on the practical application of ideas in specific situations and provides the foundations for mixed methods research. Pragmatists reject dualism and believe that one or more viewpoints are often credible. The research question is central to the problem and appropriate quantitative and qualitative methods are selected to answer the question (Johnson and Onwuegbuzie, 2004).

Within mixed methods research, quantitative and qualitative methods work synergistically. The quantitative component often measures the relationships between variables whereas the qualitative element allows

the topic to be explored in more depth. The findings from both converge to help answer complex research questions (Creswell, 2013). Greene et al. (1989) provide a rationale for mixed methods research, describing five major purposes:

1. Triangulation, which describes seeking convergence and corroboration of results from different methods.
2. Complimentary, where results provide elaboration and explanation of phenomena in greater detail.
3. Initiation, where identification of contradictions leads to revision of the research question.
4. Development, where the findings from one method are used to inform the other.
5. Expansion, which involves expanding the breadth of knowledge using different methods for different aspects of the research topic.

Many different quantitative and qualitative methods are used within mixed methods research and there are no pre-defined criteria for the stage of the research at which the methods are combined. However, where mixing occurs must be considered within research design; other considerations include the paradigm emphasis and the time ordering of the phases (Lingard et al., 2008, Creswell, 2013, Johnson and Onwuegbuzie, 2004). Quantitative and qualitative phases can be conducted concurrently to provide a more comprehensive analysis of the research question (Creswell, 2013). A sequential design can be used, for example quantitative methods are used first followed by qualitative methods on a smaller sample to provide a detailed explanation of the findings.

Alternatively the qualitative study is conducted initially followed by a quantitative phase to attempt to generalise results to a larger population (Creswell, 2013, Lingard et al., 2008). Finally, it is not uncommon for mixed methods research to follow a cyclical process where data interpretation and validation lead to the need for further data collection, or redefining the research question to be investigated (Johnson and Onwuegbuzie, 2004).

Johnson and Onwuegbuzie (2004) state that quantitative, qualitative and mixed methods research are all superior under different circumstances and as mixed methods are commonly used in educational research they should be widely recognized and accepted. This thesis is within the domain of veterinary educational research. The subjects of this thesis are final year veterinary students and recent graduates; the context is WPBL at the SVMS and within clinical practice. So a mixed methods approach has been adopted where qualitative studies aim to provide greater insight into the learning behaviour of students during their final year and their perception of the transition to practice. A qualitative approach is essential to capture the feelings, motivations and attitudes of the students and graduates within this unique context. The qualitative approach also captures the experience and perceptions of individual students, recognising that the average student does not exist and one opinion is rarely representative of the entire cohort. Quantitative studies have been used to attempt to generalise results to the wider population and also to explore relationships between attainment, approaches to learning and preparation for practice. Table 3.1 provides an overview of the qualitative and quantitative components of the studies within this thesis.

Research question	Qualitative study components	Quantitative study components	Rationale/comments
What are the intended learning outcomes of the veterinary medicine course?	Literature search and a staff focus group	Survey of teaching and support staff	A sequential study where the qualitative components were used to generate a list of learning outcomes. The online survey was then delivered to a larger sample of staff to refine and validate the ILOs.
Do teaching, learning and assessment prepare students for the demands of clinical practice?	Thematic analysis of free text responses collected via a survey of recent graduates	Statistical analysis of categorical data from the graduate survey and undergraduate assessment data	A concurrent study where the qualitative data are used to explain more in depth the quantitative findings
What is the impact of assessment methods, used in the final year of study in veterinary medicine, on learning behaviour? Part 1: a comparison of DOPS and MCQs	Thematic analysis of semi-structured interviews with students	Statistical analysis of responses from a student survey and assessment data	A sequential study where the quantitative component was delivered to the entire year initially. The qualitative study was subsequently conducted on a smaller sample of students to explore some of the quantitative findings in greater detail.

What is the impact of assessment methods, used in the final year of study in veterinary medicine, on learning behaviour? Part 2: the SCT	Thematic analysis of student focus groups.	A survey of students	A sequential study where the qualitative focus groups were carried out initially to identify student perception of the SCT. A questionnaire was developed based on the findings of the focus groups and sent to the entire year to triangulate and therefore support the findings.
What is the perception of final year students and employers of new graduates of the requirements for a successful transition to practice?	Qualitative survey of final year students and employer survey with some qualitative responses	Statistical analysis of categorical data from the employer survey and comparison of student and employer qualitative responses by magnitude coding	A sequential study where the qualitative student survey was delivered initially and used to inform the development of the employer questionnaire. The employer survey generated both quantitative and qualitative data. A quantitative approach (magnitude coding) was used for comparative analysis of the student and employer qualitative responses.

Table 3.1: An overview of the qualitative and quantitative components used within the mixed methods approach to research

3.2: Methods of data collection and analysis used within this thesis

3.2.1: Focus Groups

Developed by Merton in the 1940s (Merton and Kendall, 1946) focus groups are comprised of facilitated small group discussions. A collective view of the research subject is produced through interaction between the participants (Cohen, 2007, p.376). Within the focus group social interaction is key to generate data as discussion promotes sharing of ideas and initiates conversations that may not emerge during formal interviews (Pope and Mays, 2008, Braun and Clarke, 2013).

Advantages include participants feeling more at ease within the group environment and therefore more able to express their views; the technique allows the opinions of several individuals to be collated at once and is therefore an efficient method for gathering knowledge within a novel research area and often results in smaller sample sizes required to reach saturation (Braun and Clarke, 2013, Cohen, 2007). Furthermore, Braun and Clarke (2013) suggest that a focus group can simulate a more naturalistic environment compared to a formal interview, which is a key element for qualitative research.

One of the challenges in setting up focus groups is the logistical problem of scheduling a time and place convenient for all participants; this can be overcome to some extent by the use of technology to create virtual focus group discussions (Braun and Clarke, 2013). The group dynamic and choice of facilitator must be given careful consideration; depending on the hierarchical relationship between participants a heterogeneous group can

leave individuals feeling intimidated or less able to express their opinions (Pope and Mays, 2008). Effective facilitation of the discussion is essential and can be difficult to manage to ensure focus is maintained and that discussion can be clearly recorded. Opinion differs regarding optimal group size, Braun and Clarke (2013) suggest 3-8 for optimal discussion.

Within this thesis, focus groups have been used with students to promote discussion in a more relaxed environment than an interview, and with staff that were selected to participate based on their experience and role within the school. Within both groups consideration was given to the relationship between participants and also between the researcher and the group. Due to the role of the researcher within the school a reflexive approach (Hockey, 1993) was taken during data collection and interpretation.

3.2.2: Interviews

Interviews are increasingly used in educational research as a method of collecting qualitative data. The aim of the qualitative interview is to explore meaning and provide a more in depth understanding of the issue in question (DiCicco-Bloom and Crabtree, 2006). However it is important that these studies are informed by methodological frameworks and analysis does not rely on descriptive accounts with minimal interpretation of the data (Reeves et al., 2006). Qualitative interviews can be time consuming to conduct, transcribe and analyse. Although fewer participants are required in comparison to quantitative methods of data collection, Braun and Clarke (2013) state that lack of breadth can be a limitation to this method due to small sample sizes.

Interviews can be classified as structured, semi-structured or unstructured (Pope and Mays, 2008, Braun and Clarke, 2013). Structured interviews usually generate quantitative data whereas DiCicco-Bloom and Crabtree (2006) describe unstructured interviews as guided conversations that originate in ethnographic anthropology. Unstructured interviews are often conducted concurrently with observational field notes made by the researcher. Semi-structured interviews are used in this study. This method generates qualitative data and the interview is based around a set of pre-determined, open-ended questions. However, the conversation can evolve and explore different ideas according to the interviewee responses (Pope and Mays, 2008).

Whilst the qualitative interview calls for a flexible approach that is adapted to each participant and their context (Braun and Clarke, 2013), this has been criticised for being unreliable and therefore questions the reproducibility of the results (Cohen, 2007). Silverman (1993) suggests that piloting interview questions, ensuring the same questions for each respondent and training the interviewers can improve reliability. However these recommendations are not aligned with the ethos of interpretive research.

One of the benefits of the qualitative interview is the freedom to explore attitudes and beliefs, which can provide meaning and reasons for actions. Participants are often more open to discussing issues in depth in a one-to-one interview compared to a focus group discussion alongside their peers. However, developing rapport between the interviewer and interviewee is essential (DiCicco-Bloom and Crabtree, 2006) and as with focus groups

any hierarchical relationships must be considered during data collection and analysis.

Pope and Mays (2008) emphasize the importance of the role of the researcher and their relationship with the participants. The interviewer must avoid leading questions based on pre-conceived ideas and data interpretation must result in a true account according to the interviewee. Bias is an acknowledged cause of invalid results in qualitative research. Sources of bias can include inappropriate sampling, poor interview technique, misunderstanding of the questions by the interviewee and misinterpretation of the responses by the interviewer (Cohen, 2007).

Within this study the researcher works closely with students and the assessment process in the SVMS. It is therefore important that a reflexive approach is adopted and the relationship between interviewer and interviewee is considered during data collection and analysis.

3.2.3: Surveys

Questionnaires are used to survey a larger sample of the population compared to the focus groups and interviews previously discussed. The nature of the questions within questionnaires is variable. Closed questions with fixed responses generate quantitative data whilst open questions with free text responses generate qualitative data. Quantitative questionnaires are amenable to statistical analysis and therefore more suited to large sample sizes. Qualitative data generated from free text responses must be analysed using appropriate qualitative techniques. This can be time consuming and qualitative questionnaires are therefore more suited to

smaller sample sizes. A mix of both free text and fixed response questions is common in survey research (Braun and Clarke, 2013).

Surveys can be self or researcher administered and either paper based, email or online. These different methods of administration have their own advantages and limitations. For example self-administered questionnaires allow the participant to respond in their own time without the pressure of the researcher being present, however, there is no opportunity to ask for clarification over questions. Whilst online surveys allow rapid responses and target large numbers, they may exclude groups of the population without access to the internet (Cohen, 2007).

Questionnaire based surveys are commonly used within educational research. However, there are limitations to this method that must be considered in questionnaire design and data interpretation if meaningful conclusions are to be made. Opinions, perceptions and attitudes provided in response to a questionnaire do not necessarily indicate behaviour (Cohen, 2007). For example a student might strongly agree with the statement "It is important to work hard throughout the year" but this response does not measure how much work they actually do. A lack of flexibility, particularly in fixed response questions and poorly worded questions are common pitfalls in survey-based research. Piloting of questionnaires before data collection can address many of these issues (Braun and Clarke, 2013).

3.2.3.1: Rating scales

Introduced in 1932 by Rensis Likert (1932), Likert scales are a type of rating scale commonly used in questionnaires to measure the range or

intensity of a response. Usually between 4 and 7 response options are provided, generating categorical data that is often more meaningful when considering complex issues than that generated from dichotomous questions. Rating scales are therefore useful for measuring attitudes, perceptions and opinions (Cohen, 2007) and are used within the studies in this thesis.

Despite their widespread use, analysis and interpretation of these types of data is inconsistent and often controversial. One common but incorrect assumption is that of equal intervals between categories. Likert responses should be treated as ordinal data and therefore be analysed using non-parametric statistical tests (Cohen, 2007). Another limitation is the tendency for participants to select the neutral mid-point; respondents who do not wish to appear extremist often favour this strategy. One way to minimise this effect is to select a scale with an even number of response options that can force the respondent into a decision (Cohen, 2007).

3.2.3.2: Psychological measures in surveys

Many questionnaires have been developed to measure psychological parameters such as personality type and learning styles. The advantage of using these "off the shelf" tests is that they have been previously validated and shown to be a reliable measure of a given attribute. This is useful in studies where sample sizes are too small to allow factor analysis and other statistical measures to demonstrate validity. However, consideration must be given to the context of their use as validity may be challenged when using a questionnaire in a different environment or with different participants. Examples of existing questionnaires designed to

measure learning style include the Approach to Study Inventory (Entwistle et al., 1979), the Course Evaluation Questionnaire (Ramsden, 1991), Kolbs Learning Styles Inventory (Kolb, 1976) later adapted by Honey and Mumford (1992) and the Study Process Questionnaire (SPQ) developed by Biggs (1987b) and used within this thesis.

The SPQ is used in study 3 (chapter 5), a comparison of students' learning approach to DOPS and MCQ assessments. The justification for its use will be discussed within this chapter on research design. The questionnaire was chosen for use in this thesis as it has been previously used and validated within medical education (McManus et al., 1998, McManus et al., 1999) and also with students completing a health sciences degree course (Donnon and Hecker, 2010). In the author's opinion the SPQ provides a useful measure of approach to learning (surface, deep or achieving) without being too complex. The achieving strand was considered to be important in the context of the veterinary degree course where assessment is thought to be demanding. It was anticipated that many students would resort to an achieving approach and so the revised version of the SPQ was not used. Each approach is characterised by a motivation and a strategy. Motivation was considered to be an important attribute to explore given the nature of the vocational veterinary degree course where students are hopefully motivated not only by the academic qualification but also by the profession they will enter post-graduation.

3.2.4: Thematic analysis

Thematic analysis (TA) describes the process of identifying themes and patterns within qualitative data in response to a research question (Braun

and Clarke, 2013). Historically TA has been considered as a method integral to other theoretically driven qualitative approaches. However, Braun and Clarke (2006) described TA as a method in its own right, and it is now widely accepted in a range of contexts including psychology, healthcare science and veterinary educational research for example, Coe et al. (2012), Baillie et al. (2010).

TA is a flexible approach in that methods of data collection are not prescribed, it is used to analyse qualitative data from a range of different sources. A potential weakness of TA is the lack of interpretation resulting in a largely descriptive account of the results. However, with careful planning and when used within existing theoretical frameworks, TA can be more than just content analysis providing a rich and detailed view of complex situations.

Codes and themes are identified during analysis by one of two main approaches. Inductive analysis involves working from the data upwards where themes are often described as 'emerging' from the data. Alternatively a deductive approach can be used where a theoretical framework is used to determine *a priori* codes that are applied to the data. Inductive and deductive approaches are often combined in one analysis (Braun and Clarke, 2013) this combined approach is utilised within the studies in this thesis.

3.2.5: Sampling

An appropriate sampling strategy ensures that where possible the results of a study are generalizable to the wider population. When selecting a sample population several factors must be considered. Firstly the size and

representativeness of the sample are fundamental to generalizability. Secondly consideration must be given to access to the subjects within the population, so that the planned study is feasible. Finally the sampling strategy must be decided (Cohen, 2007, p.110).

Generally, in a random sample of any given population the larger the sample the more representative it will be of the population and the more heterogeneous a population is the larger the sample required (Cohen, 2007, p.101). Sample sizes tend to be larger in quantitative studies compared to qualitative studies (Braun and Clarke, 2013). Within qualitative research, the point of saturation following data analysis often determines the number of participants. In contrast quantitative research often involves a sample size calculation, performed prior to the study, based on the degree of accuracy required (Sandelowski, 1995).

Convenience or opportunistic sampling is based on the availability of participants (Brown and Edmunds, 2011, p.84) and has been used to select participants within this thesis. Students were requested to volunteer to take part in the research and that can result in bias. Volunteers may have their own motivation for participating, for example an interest in the research or dissatisfaction with the course. Their opinions may not therefore be representative of the student body as a whole.

Purposive sampling involves selecting participants deliberately based on their possession of certain characteristics, experience or knowledge (Cohen, 2007, p.114). This method has been adopted in this thesis to recruit staff participants. The results may not be generalizable to all SVMS

staff however, those selected had an in depth knowledge of the SVMS course based on a range of experience within the school.

Both opportunistic and purposive sampling strategies are non-probability sampling methods. Sample selection is not random and therefore the chances of an individual within the population being selected to participate are not equal. Results obtained and conclusions drawn from this research therefore are not automatically generalizable to the wider population.

Snowball sampling involves selection of a small sample of participants with the required characteristics for the study. These participants are then asked to identify further individuals who meet the requirements for the study. This process is repeated until an appropriate sample size is reached (Cohen, 2007, p.116, Brown and Edmunds, 2011, p.84). This sampling strategy was used to recruit practitioners to maximise the number of participants.

Other methods utilised to increase sample sizes include increasing accessibility of questionnaires by producing both electronic and paper based formats. Response rates to surveys have been shown to increase by as much as 50% by follow up telephone calls and sending reminder mailings (Richardson et al., 2007). Finally, although recompense for participation is controversial (Braun and Clarke, 2013) offering incentives is often used to increase response rates and numbers of volunteers. These methods have been used in the research in this thesis to maximise response rates.

3.3: Ethical approval

The research within this thesis involves data collection from students and staff of the SVMS and also veterinary practitioners not employed by the university. It is important to consider the potential impact of the research on the participants. The primary researcher is a member of SVMS staff and all participants, in particular students and staff, must feel able to speak freely without being concerned over the consequences of their participation. In addition participation can be time consuming and the impact of this must be kept to a minimum. Therefore the logistics and methods of data collection, confidentiality and anonymity of responses were considered prior to commencement of the research.

This research was approved by the SVMS ethical review panel (approval number 361 11 04 18, details of consent and ethical review are provided in appendix 1) and conducted in accordance with the University of Nottingham Code of Research Conduct and Research Ethics and the guidance outlined in the 'Revised Ethical Guidelines for Educational Research' by the British Educational Research Association (BERA, 2011).

Details of consent obtained for each individual study are provided within the relevant chapters.

3.4: Summary of Chapter 3

A pragmatic approach using mixed methods has been adopted to address the research questions within this thesis. This chapter has provided an overview of the mixed methods approach with reference to the studies in this thesis and a discussion of the individual research methods used. In

the following chapters the specific details of each study method will be provided.

Chapter 4: Indirect Outcomes Assessment

4.1: Introduction

Defining and assessing the intended learning outcomes of a course (ILOs) is an essential first step in the investigation of constructive alignment (CA) within a curriculum. This chapter describes this first step: the development and implementation of the SVMS outcomes assessment (OA). The first study answers research question 1:

1. What are the intended learning outcomes of the veterinary medicine course?

Figure 4.1 illustrates where study 1 fits within the overall research plan.

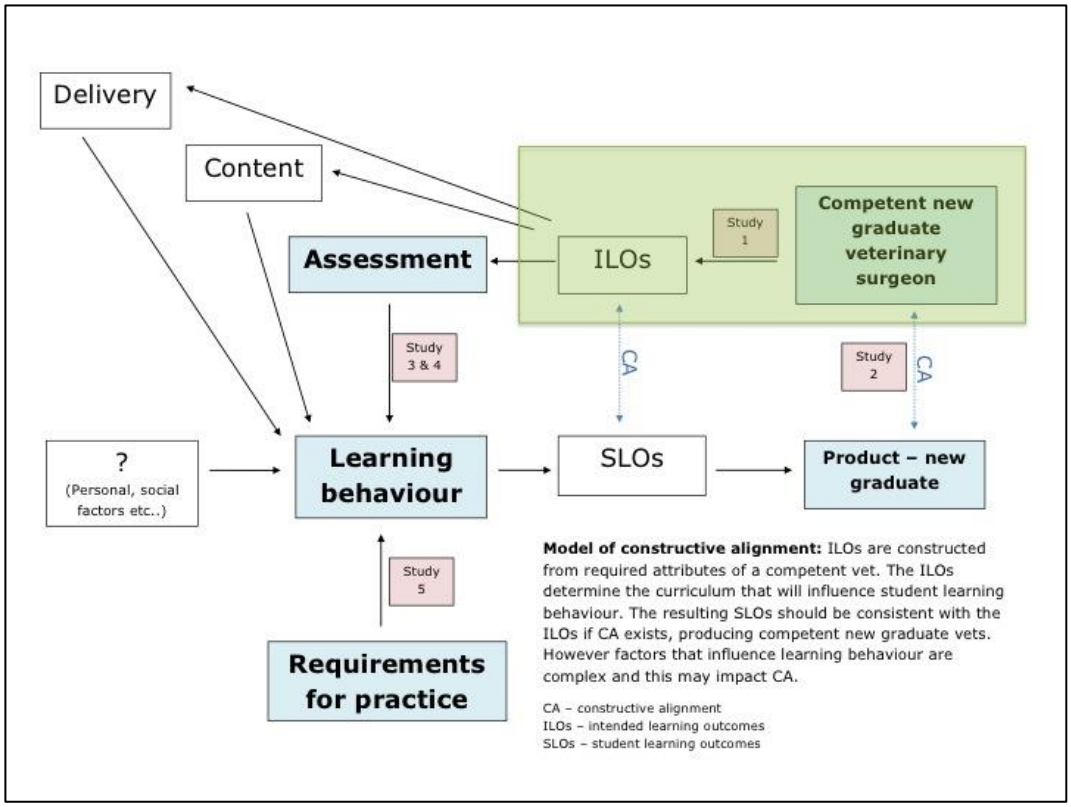

Figure 4.1. A model of constructive alignment highlighting study 1: defining the desired skills and attributes of the SVMS graduate.

An outcomes-based approach was adopted in the original design of the SVMS veterinary curriculum, and therefore a set of programme learning outcomes existed within the course documentation. However, they were written prior to the school opening in 2006 and were not considered to be appropriate for use in the outcomes assessment exercise. The existing outcomes within the programme specification were written by a small number of staff prior to the course being delivered. These programme outcomes consisted of school objectives regarding resources and delivery methods in addition to ILOs for the students. Therefore, neither were they a list of ILOs nor did they necessarily reflect the current SVMS curriculum. The RCVS day one competences were considered as the ILOs for the OA. However, they are not specific to the SVMS graduate and were under review at the time the research was carried out. It was therefore decided to review the ILOs for the purpose of the OA and produce a set of outcomes that were a more appropriate reflection of the current SVMS curriculum. This was done following a systematic review of the literature and collating the opinions of SVMS staff, this process is described in section 4.2 of this chapter.

Section 4.3 provides an account of the graduate survey used for the indirect assessment of the defined ILOs. This second study aims to answer research question 2:

2. Do teaching, learning and assessment prepare students for the demands of clinical practice?

The results describe how well prepared the graduates felt for clinical practice in relation to each of the ILOs. Their perception of the SVMS

assessment strategy is also explored as well as the relationship between undergraduate attainment and the extent to which they felt prepared for their current role in veterinary practice. Figure 4.2 illustrates where this second study fits within the overall research plan.

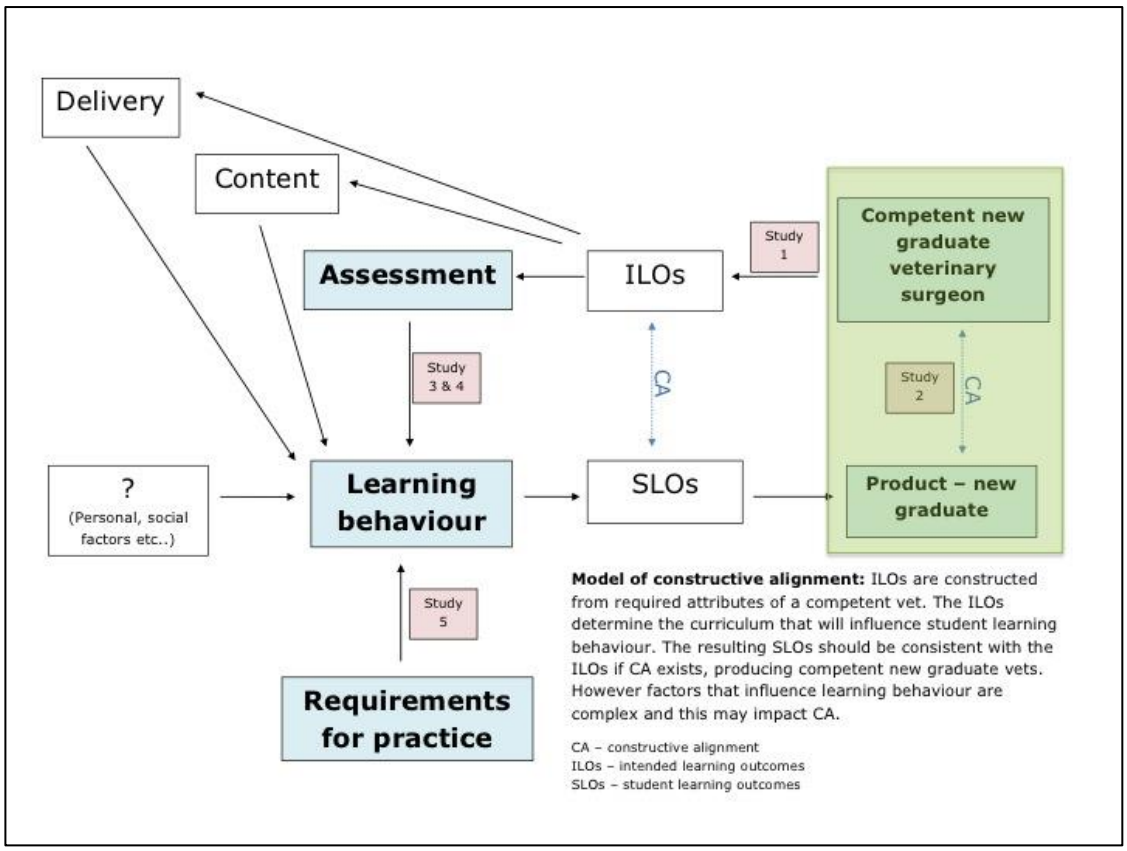

Figure 4.2. A model of constructive alignment highlighting study 2: the SVMS outcomes assessment.

4.2: Study 1: Defining the ILOs of the SVMS graduate

There were three stages in the process of defining the ILOs of the SVMS graduate. Firstly a systematic review of the literature was conducted; the second stage consisted of a focus group to collate SVMS staff opinion. Finally a survey was carried out to validate the final list of ILOs. The ILOs are expressed as desired characteristics, skills or attributes, this format

was considered appropriate for the purpose of the graduate survey and is consistent with similar studies (Walsh et al., 2001, Doucet and Vrins, 2009, Mellanby et al., 2011). For example the learning outcome: "perform a full clinical examination on all commonly encountered species" is written as "clinical examination skills" followed by a brief explanation of the level of detail expected.

4.2.1: A systematic review of the literature

A systematic review of the literature was conducted to produce a list of previously identified skills and attributes required by veterinary graduates commencing a career in practice. The method used was based on the BEME protocol as used by Rhind et al. (2008). The following search terms were used to search the databases: *graduate attributes; day one competences; outcomes assessment and transition to practice*. Boolean search terms were used to refine the results of the searches. Table 4.1 summarises the databases and other sources searched within the review.

Databases	Other sources
CAB Abstracts (Ovid)	Google Scholar search engine
MEDLINE (Ovid) 1948-present	JVME
Web of Science (ISI)	Veterinary Record
	SVMS survey of employers and other stakeholder groups[1]
	SVMS course documentation
	RCVS Day one competences

Table 4.1: Databases and other sources searched in the literature review

The following inclusion criteria were applied to the search results:

1. Articles must be in the context of veterinary education or veterinary practice.
2. A list of ILOs of a course or desired graduate attributes must be included.
3. The list of ILOs or attributes must be for the entire programme and not just specific to one module or course component.

13 articles were identified which matched the inclusion criteria and were used to develop the desired attributes of the SVMS graduate. These articles are listed in Table 4.2. The initial list of attributes identified was reviewed for overlap or repetition, resulting in a list of 130 attributes assigned to one of 22 groups according to the type of skill or attribute. A

[1] A survey was conducted by the SVMS, prior to its opening in 2006, to employers and other stakeholder groups to facilitate outcome-based curriculum design. Participants were asked to provide details of commonly encountered conditions and cases they considered new graduates should be able to deal with, as well as additional topics they felt should be included in the curriculum

table containing all the attributes identified and the groups to which they were assigned is included as appendix 2.

Title	Author(s)	Journal	Year
The Importance of Knowledge, Skills and Attitude Attributes for Veterinarians in Clinical and Non-clinical Fields of Practice: A Survey of Licensed Veterinarians in Quebec, Canada	Doucet & Vrins	JVME	2009
The Transition from Veterinary Student to Practitioner: A "Make or Break" Period	Gilling & Parkinson	JVME	2009
Criteria used by Employers to Select New Graduate Employees	Heath & Mills	Aus Vet J	2000
Gender Differences and the Definition of Success: Male and Female Veterinary Students' Career and Work Performance Expectations	Kogan et al.	JVME	2004
Perceptions of Clients and Veterinarians on what Attributes Constitute 'a Good Vet'	Mellanby et al.	Vet Record	2011
The Transition into Veterinary Practice: Opinions of Recent Graduates and Final Year Students	Rhind et al.	BMC Med Ed	2011
Veterinary Students' Perceptions of Their Day-One Abilities before and after Final-Year Clinical Practice-Based Training	Schull et al.	JVME	2011
Defining the Attributes Expected of Graduating Veterinary Medical Students	Walsh et al.	JAVMA	2001
Employer and New Graduate Satisfaction with New Graduate Performance in the Workplace within the	Butler	Can Vet J	2003

First Year Following Convocation from the Ontario Veterinary College			
Predictors of Employer Satisfaction: Technical and Non-technical Skills	Danielson et al.	JVME	2012
Use of Alumni and Employer Surveys for Internal Quality Assurance of the DVM Program at the University of Montreal	Doucet & Vrins	JVME	2010
An Alumni Survey to Assess Self-Reported Career Preparation Attained at a US Veterinary School	Hardin & Ainsworth	JVME	2007
Outcomes Assessment at Tufts University School of Veterinary Medicine	Kleine et al.	JVME	2002

Table 4.2: Papers identified in the literature search that met the inclusion criteria of the systematic review

4.2.2: The focus group

A focus group was run with the aim of producing a set of desired attributes for the Nottingham veterinary graduate, as defined by SVMS staff. A purposive sample of six members of staff attended the focus group, including three clinicians, two non-clinical academics and the school manager. The staff members were selected to ensure the group had a broad knowledge and range of experience of the SVMS course. Between the focus group participants they had experience of the course from the first intake of students, student welfare and support, tutoring, the role of module convener, student EMS placements and all forms of

teaching including facilitation of small group work and teaching students in clinics during university rotations.

Prior to commencing the focus group participants were given 2 copies of a letter informing of them of the study and requesting their consent to participate (see appendix 3 for a copy of the letter). One signed copy was retained by the researcher, participants kept the second copy for their records.

The participants were given an explanation of the aim of the focus group and were first asked to write down their own list of SVMS graduate attributes without discussion with the rest of the group. Following this a list of attributes agreed by the group was produced on a whiteboard. Compilation of this list involved an iterative process where discussion, facilitated by the researcher, resulted in the initial list being reviewed and amended by the group. This process continued until all members were agreed that the list was a complete list of essential SVMS graduate attributes. The whiteboard was photographed and individual attribute lists were collected and checked against the group list to ensure the list was inclusive of all opinions. A list of the attributes produced in the focus group can be found in appendix 4, along with photographs of the whiteboard.

4.2.3: The staff survey

The results of the focus group were cross-referenced with the results of the literature search. A final list of 25 graduate attributes was produced. A purposively sampled panel of 33 SVMS and clinical associate staff were surveyed to validate the final list of graduate attributes. An online

questionnaire was delivered using SurveyMonkey™ (http://www.surveymonkey.com). Participants were asked to rate each of the attributes for importance on a scale of 1 to 5 and also to provide any comments they had on the individual outcomes. Figure 4.3 provides an example section from the questionnaire.

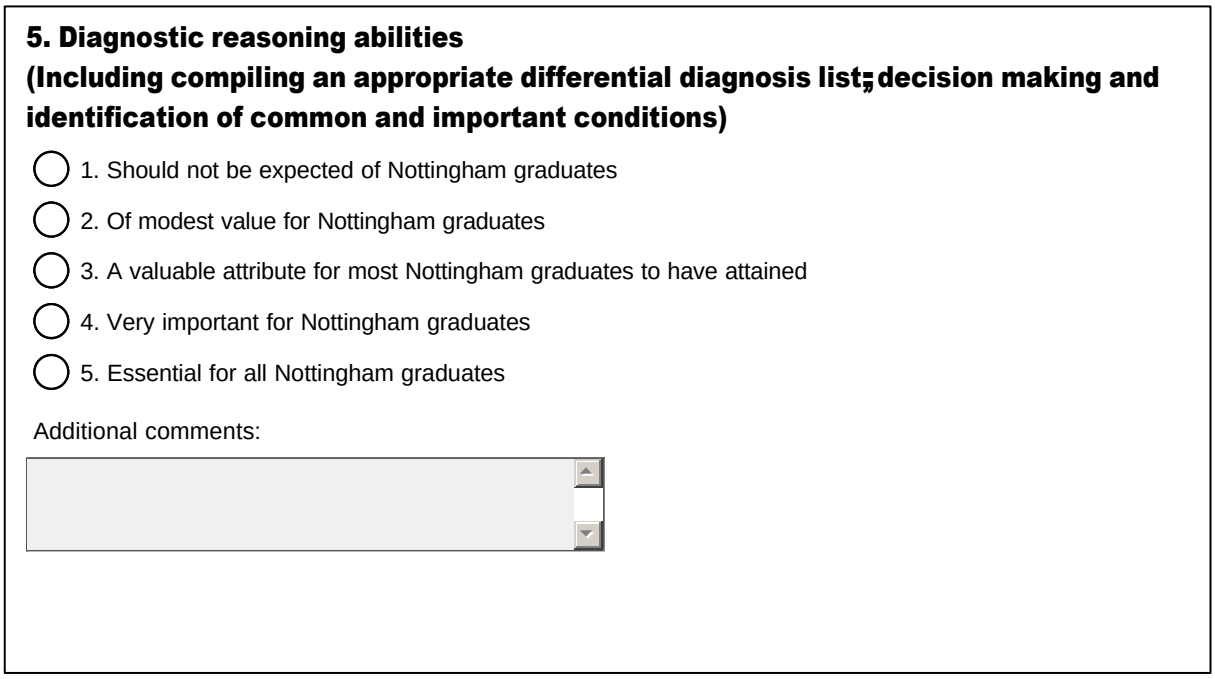

Figure 4.3: An example section from the online questionnaire asking staff to rate each of the attributes for importance to the SVMS graduate.

Nineteen staff responded to the survey, a response rate of 57.6%. All attributes were considered important and therefore none were removed from the list. A summary of the ratings for each attribute is provided in table 4.3. The additional free text comments from respondents resulted in some minor changes to the wording of some of the attributes. Details of the comments and actions are provided in table 4.4.

Summary of attribute	Median	Mode	Min.	Max.	Mean	Std. Dev
Clinical examination skills	5.00	5.00	4.00	5.00	4.89	.32
Veterinary Clinical Knowledge	5.00	5.00	4.00	5.00	4.84	.37
Clinical and surgical skills	5.00	5.00	4.00	5.00	4.79	.42
Implementation of euthanasia	5.00	5.00	3.00	5.00	4.79	.54
Recognising own limitations	5.00	5.00	4.00	5.00	4.79	.42
Communication skills	5.00	5.00	4.00	5.00	4.79	.42
Professional responsibilities	5.00	5.00	4.00	5.00	4.74	.45
Diagnostic reasoning abilities	5.00	5.00	4.00	5.00	4.68	.48
Case management and therapeutics	5.00	5.00	4.00	5.00	4.68	.48
Knowledge of basic science	5.00	5.00	3.00	5.00	4.63	.60
Application of ethics to animal welfare	5.00	5.00	3.00	5.00	4.58	.61
Promoting preventative healthcare	5.00	5.00	3.00	5.00	4.47	.77
Knowledge of veterinary legislation	5.00	5.00	3.00	5.00	4.42	.77
Seek and utilise new information	4.00	5.00	3.00	5.00	4.37	.68
Emergency and critical care cases	4.00	4.00	3.00	5.00	4.32	.67
'Robustness' – stress management	5.00	5.00	3.00	5.00	4.32	.82
Problem solving and critical thinking	4.00	4.00	3.00	5.00	4.26	.73
Interpersonal and teamwork skills	4.00	5.00	3.00	5.00	4.16	.83
Veterinary public health & zoonoses	4.00	4.00	2.00	5.00	4.05	.91
Maintaining a work life balance	4.00	4.00	3.00	5.00	4.00	.75
Flexibility	4.00	3.00	3.00	5.00	3.89	.81
Population health and epidemiology	3.00	3.00	2.00	5.00	3.74	.99
IT skills	4.00	4.00	3.00	5.00	3.68	.67
Veterinary practice management	3.00	3.00	2.00	5.00	3.63	.90
Research skills	3.00	3.00	2.00	5.00	3.42	1.01

Table 4.3: Importance ratings for each of the graduate attributes: descriptive statistics. 5 = maximum and 1 = minimum importance. Where multiple modal values exist the smallest value is given.

Attribute	Summary of comment(s)	Action
Knowledge of underpinning basic science (Including normal structure and function of healthy animals; molecular, biochemical and cellular mechanisms; mechanisms of defence; animal management, nutrition and husbandry systems)	The relevance of the basic science was questioned as was the amount of detail and level required.	Wording changed to "Knowledge of underpinning basic science at a level appropriate for your current role"
Veterinary Clinical Knowledge (Including disease aetiology and pathophysiology; mechanisms of disease transmission; knowledge of medical and surgical management)	The level of detail required is not clear.	Wording changed to "Veterinary clinical knowledge at a level appropriate for your current role"
Clinical and surgical skills (Including diagnostic imaging skills; basic surgical skills; anaesthesia skills and fluid therapy)	It is not clear as to how independent the graduate needs to be on day 1, is a certain level of supervision assumed?	It is likely that this will vary depending on the graduate and type of practice. Therefore the following phrase was added to the initial instructions: "Thinking about the demands of your current role, use the following options to tell us how prepared you feel for your job in each area"
Dealing with emergency and critical care cases (Including triage of emergency cases)	Need to add detail to explain	Amended wording: "(Including initial assessment

	what is meant by triage.	and triage of emergency cases)"
Promoting preventative healthcare	This should be written preventive not preventative	Looked at definitions and examples. Both are used interchangeably, preventative used more frequently therefore no changes made
Awareness of professional responsibilities to patients, clients, colleagues, society (Including understanding the needs and maintaining respect for all clients; engagement in CPD and life long learning; putting EBVM into practice and respectfully challenging bad practice; maintaining a safe working environment; showing a caring attitude towards colleagues and shaping the future of the profession)	Bad practice should only be challenged if EBVM actually exists and there should be respect for valid differences in opinion between clinicians.	Existing wording does state "*respectfully* challenging bad practice" Therefore due to the volume of information already included in brackets it was decided to leave the wording as is.
'Robustness' – the ability to cope with pressure and stress	This should include knowing when to ask for help.	This is addressed in attribute 13: Recognising limitations. The word 'cope' has been changed to 'manage' to emphasize an active response is required
Systematic approach to problem solving and critical thinking	Overlap with diagnostic reasoning and case	This was discussed during the focus group, it was considered important to include this in addition to clinical reasoning. In addition it was rated highly

	management.	(mean 4.3 median 4) therefore no changes made.
IT skills	This needs defining to make it clear exactly this entails.	As this is likely to vary according to the type of practice and individual roles the wording has been changed to: "IT skills required for your current role
Research skills	One comment suggested further definition to explain evaluation of current literature rather than ability to carry out scientific research. However, others suggest the latter is important as they are awarded a BVMedSci degree.	Left unchanged.
Empathy	Empathy is not included	This is already included within communication skills. Therefore no change
Numeracy	Should numeracy be included as a separate attribute?	Drug dose calculations are specifically stated within attribute 6: Case management and therapeutics. Numeracy skills are also integral to

		financial management within attribute 11. Therefore numeracy is not included as a standalone skill but required as an applied skill
Wider role within society	Ability to play a role in wider society, for example charity work should be included	A professional responsibility to society is included in attribute 17. Whilst this would be a commendable attribute, a wider role was not considered to be an achievable or measurable ILO for all students.
Compassion for animals and the application of ethics to animal welfare	Ethics should be linked with critical thinking not just welfare	This was not changed. It was considered to be covered adequately within the existing wording and including ethics within a systematic approach to problem solving and critical thinking would change the meaning of this attribute

Table 4.4: A summary of the comments received and changes made to the list of graduate attributes following the staff survey.

4.2.4: Results of study 1: defining the ILOs of the SVMS graduate.

The final set of desired skills and attributes of the SVMS graduate are shown in figure 4.4:

1. **Knowledge of underpinning basic science**
   (Including normal structure and function of healthy animals; molecular, biochemical and cellular mechanisms; mechanisms of defence; animal management, nutrition and husbandry systems)
2. **Veterinary clinical knowledge**
   (Including disease aetiology and pathophysiology; mechanisms of disease transmission; knowledge of medical and surgical management)
3. **Clinical and surgical skills**
   (Including diagnostic imaging skills; basic surgical skills; anaesthesia skills and fluid therapy)
4. **Clinical examination skills**
   (Within all species and including animal handling and an understanding of animal behaviour)
5. **Diagnostic reasoning abilities**
   (Including compiling an appropriate differential diagnosis list; decision making and identification of common and important conditions)
6. **Clinical case management and therapeutic strategies**
   (Including making therapeutic decisions; prescribing and dispensing appropriately and legally; performing drug dose calculations and reproductive management)
7. **Dealing with emergency and critical care cases**
   (Including initial assessment and triage of emergency cases)
8. **Promoting preventative healthcare**
9. **Population health and epidemiology**

10. **Dealing with veterinary public health and zoonotic issues**
(Including notifiable diseases and an understanding of the importance of food safety)

11. **Recognition for need and implementation of euthanasia**

12. **Veterinary practice and financial management**
(Including financial awareness in case management)

13. **Recognising own limitations and seeking help and advice where needed**
(Including reflective practice and being open to constructive criticism)

14. **Ability to seek, critically evaluate and utilise new information from a variety of sources**

15. **Knowledge of current veterinary legislation**

16. **Compassion for animals and the application of ethics to animal welfare**

17. **Awareness of professional responsibilities to patients, clients, colleagues, society**
(Including understanding the needs and maintaining respect for all clients; engagement in CPD and lifelong learning; putting EBVM into practice and respectfully challenging bad practice; maintaining a safe working environment; showing a caring attitude towards colleagues and shaping the future of the profession)

18. **Communication skills**
(Including empathy and communication with clients; written communication skills for example clinical records and referral letters; communication with veterinary colleagues and paraprofessionals)

19.	**Interpersonal and teamwork skills** (Including Leadership skills; showing initiative in the workplace; time management skills and confidence to take control of a situation)
20.	**'Robustness' – the ability to manage pressure and stress**
21.	**Flexibility and ability to cope with change**
22.	**Self-reflection and maintaining a work life balance**
23.	**Systematic approach to problem solving and critical thinking**
24.	**IT skills required for your current role**
25.	**Research skills**

Figure 4.4: The desired skills and attributes of the SVMS graduate.

These desired skills and attributes were used as the basis for the graduate survey, described in the following section.

4.3: Indirect outcomes assessment

4.3.1: The content of the Graduate Survey

The final graduate survey included 3 sections: the veterinary course at Nottingham, the way in which students were assessed and general information. The survey was approved by the senior management team and sent out with a covering letter to all graduates from the Dean of the School requesting their participation. A copy of the covering letter is included as appendix 5.

In section 1, “The veterinary course at Nottingham”, graduates were asked to rate on a Likert type scale how prepared they felt with respect to each of the ILOs (determined in study 1) in the context of their current employment. One further question asked them to rate how well prepared they felt overall for their current role. In section 2, “How you were assessed”, they were asked to rate the different assessment formats utilized at SVMS as preparation for their current role. Section 3, “General information”, included five general questions about their employment experience since graduation. Space was provided after each question for optional free text responses.

Example questions from sections 1 and 2 of the graduate survey are included in figure 4.5. A copy of the complete survey is included in appendix 6.

Section 1: The veterinary course at Nottingham

Thinking about the demands of your current role, use the following options to tell us how prepared you feel for your job in each of area:

Excellent preparation, I am able to carry out all requirements of my current job

Good preparation, I have needed minimal support or training since graduation

Adequate preparation, I felt somewhat prepared although have needed to utilise support and training since graduation

Poor preparation, insufficient coverage of this area in the course to be adequately prepared, significant support and training post-graduation have been necessary

Not at all prepared, the course did not prepare me at all to carry out the requirements of my current job in this area, further support and training have been essential

2. Veterinary Clinical Knowledge at a level appropriate for your current role.

(Including disease aetiology and pathophysiology; mechanisms of disease transmission; knowledge of medical and surgical management)

26. Overall competence to do the job for which you were hired

Section 2: How you were assessed

Please tell us your views on the methods of assessment at Nottingham. Consider the way in which you prepared, the experience of sitting the assessment and the feedback you received for each of the following assessments and rate how useful it was in preparation for your career by selecting one of the following options:

Excellent preparation, very relevant to my current role

Good preparation, relevant to my current role

Adequate preparation, somewhat relevant to my current role

Poor preparation, little relevance to my current role

Not at all prepared, not relevant to my current role

2. DOPS

(Directly observed procedural skills performed on clinical rotations)

4. OSCEs/OSPEs

(Objective structured clinical/practical examinations sat in 1st, 2nd and 3rd year)

Figure 4.5: Example questions from sections 1 and 2 of the graduate survey

4.3.2: Graduate Survey distribution

The graduate survey was sent out to all (87) 2011 graduates in December 2012 as a pilot study. The pilot remained open for 4 weeks and results were reviewed before sending the final version to all (89) 2012 graduates in February 2013.

All graduates were given the opportunity to complete the survey on paper and return in a prepaid envelope, or complete the survey online using SurveyMonkey™ (http://www.surveymonkey.com). Postal surveys were numbered and each number linked to an individual graduate. The graduates were asked to supply their name on the online version, otherwise the paper and online surveys were identical.

Both cohorts were given 4 weeks to complete the survey. A reminder email was sent out 2 weeks before closure of the survey and a link posted on the alumni Facebook page to increase the number of responses.

Data from both online and paper based responses were anonymised and entered into an excel database for analysis.

4.3.3: Data analysis

Quantitative data were analysed in SPSS Statistics, version 17. Likert-type descriptors were converted to numerical responses where 5 = excellent preparation, 4 = good preparation, 3 = adequate preparation, 2 = poor preparation and 1 = not at all prepared. Descriptive statistics were run on all Likert-type responses and values of Skewness and Kurtosis calculated to check for normality. Reliability coefficients (Cronbach's alpha) were calculated for sections 1 and 2 of the survey. Friedman's ANOVA was used to compare the responses to different ILOs and assessment formats. Mann Whitney U tests were used to compare the responses of 2011 and 2012 graduates and the responses of male and female graduates. A Kruskal-Wallis test was used to compare responses from graduates working in different practice types (small animal, equine, farm animal and mixed practice).

Spearman's rho correlation coefficients were calculated to identify any correlation between attainment in undergraduate assessment and responses to section 1 of the graduate survey. Attainment in the following undergraduate assessments was selected for correlations:

BVMedSci: overall mark for years 1-3 of the course

BVM BVS: overall mark for years 4 and 5 of the course

Portfolio: mark awarded for the portfolio assessment in year 5

SCT: combined mark for the SCT papers in year 5

MCQ: combined mark for the MCQ papers in year 5

For all statistical analysis, significance was measured as $p \leq 0.05$

The free text responses from the survey were assigned an initial code and used to support the quantitative data, the qualitative data was then further analysed by thematic analysis (Braun and Clarke, 2006). The computer assisted qualitative data analysis software, QSR International NVivo version 10 (2012), was used to facilitate analysis of the free text responses.

4.3.4: Results from the graduate survey

Twenty eight responses from the 2011 graduates (response rate 32.2%) and 38 responses from the 2012 graduates (response rate 42.7%) were received, a total of 66 responses and an overall response rate of 37.5%.

Following the pilot study a question was added to the electronic version of the survey asking respondents for their name, so the results could be compared to undergraduate assessments. No further changes were made

to the survey following the pilot study and responses from both 2011 and 2012 graduates were used in all analyses. 4 of the 2011 graduates who responded to the online survey could not be identified; similarly 2 of the 2012 graduates who responded only completed section 1 of the survey and so responses from these 6 graduates were not included in the correlation with the undergraduate assessment. Cronbach's alpha coefficient for section 1 was .87 and .66 for section 2.

The following sections present the results of each of the three sections of the survey followed by the correlation of undergraduate attainment and perceived preparation for practice.

4.3.4.1: Section 1: The veterinary course at Nottingham as preparation for practice

The graduates generally felt well prepared by the Nottingham course with respect to the ILOs. A summary of the graduates' responses to all 25 ILOs and the statement "Overall competence to do the job for which you were hired" are provided in table 4.5.

Summary of ILO	Mean	SD	Median	Min	Max
16. The application of ethics to animal welfare	4.72	0.43	5.00	3.00	5.00
18. Communication skills	4.71	0.70	5.00	3.00	5.00
13. Recognising limitations and seeking help	4.61	0.61	5.00	3.00	5.00
4. Clinical examination skills	4.58	0.59	5.00	3.00	5.00
11. Implementation of euthanasia	4.50	0.61	5.00	3.00	5.00
17. Awareness of professional responsibilities	4.49	0.64	5.00	3.00	5.00
19. Interpersonal and teamwork skills	4.39	0.68	4.50	3.00	5.00
14. Ability to utilise new information	4.36	0.65	4.00	3.00	5.00
24. IT skills	4.29	0.87	4.00	1.00	5.00
21. Flexibility and ability to cope with change	4.27	0.67	4.00	3.00	5.00
23. Problem solving and critical thinking	4.26	0.60	4.00	3.00	5.00
5. Diagnostic reasoning abilities	4.21	0.64	4.00	3.00	5.00
26. Overall competence to do the job	4.21	0.62	4.00	3.00	5.00
2. Veterinary clinical knowledge	4.20	0.66	4.00	3.00	5.00
22. Self reflection and work life balance	4.18	0.82	4.00	2.00	5.00
1. Knowledge of underpinning basic science	4.17	0.62	4.00	3.00	5.00
8. Promoting preventative healthcare	4.12	0.71	4.00	2.00	5.00
20. Robustness	4.09	0.74	4.00	2.00	5.00
12. Veterinary practice and financial management	4.05	0.79	4.00	2.00	5.00
25. Research skills	4.03	0.70	4.00	2.00	5.00
3. Clinical and surgical skills	3.99	0.73	4.00	2.00	5.00
9. Population health and epidemiology	3.89	0.75	4.00	1.00	5.00
6. Clinical case management and therapeutics	3.86	0.77	4.00	3.00	5.00
10. Veterinary public health and zoonoses	3.70	0.83	4.00	2.00	5.00
15. Knowledge of current veterinary legislation	3.61	0.75	4.00	2.00	5.00
7. Dealing with emergency and critical care cases	3.59	0.77	4.00	2.00	5.00

Table 4.5: A summary of graduates' responses showing preparation for practice. 5 = Excellent preparation and 1 = Not at all prepared. Seven items are highlighted: the 3 ILOs for which they felt most and the 3 ILOs for which they felt least prepared along with the responses to the statement: "Overall competence to do the job for which you were hired".

The combined mean for all 25 ILOs was 4.19; the mean for overall competence to do the job for which they were hired was 4.36. There was a significant difference comparing the responses for the 3 ILOs they felt most prepared and the 3 ILOs they felt least prepared ($\chi^2(5)=183.16$, $p=0.00$). These results suggest that graduates feel well prepared for clinical practice overall, however there are areas where they feel significantly less well prepared.

There were no statistically significant differences in the responses from 2011 graduates compared to 2012 graduates or comparing responses from male and female graduates.

When comparing responses for graduates working in different types of practice, there were significant differences for ILO 5, diagnostic reasoning abilities which was rated lowest by equine and farm practitioners and highest by those in mixed practice. ILO 10, dealing with veterinary public health and zoonotic issues was rated lowest by those in farm animal practice and highest by the small animal practitioners. Finally ILO 22, self-reflection and maintaining a work life balance, rated lowest by those in equine practice and highest by those in mixed practice. These results are presented in table 4.6.

ILO	Small animal Mean (n=30)	Equine practice Mean (n=6)	Mixed practice Mean (n=18)	Farm animal Mean (n=8)	Chi-Square	P value
5	4.07	4.00	4.56	4.00	8.74	.033
10	3.93	3.17	3.72	3.13	14.57	.002
22	4.30	3.33	4.44	3.75	9.93	.019

Table 4.6: Differences in responses from graduates working in different types of practice

The free text comments generally supported the quantitative results for the highest rated ILOs demonstrated by the quotes in table 4.7. Participants are referred to by cohort (11 or 12) followed by number, for example 11.1, 12.2 etc.

ILO	Quote
18	*"I never realised how much I would rely on our communication training from Day One after graduating - THANK YOU for preparing me!"* [12.7]
4	*"Practice makes perfect! Glad that we had plenty of chances to examine 'normal' animals."* [11.23]
13	*"Felt that Pebble pad helped with reflection and knowing personal limitations etc."* [12.17]

Table 4.7: Quotes to support the highest rated ILOs

However, some graduates identified opportunities for development even in these highly valued aspects of the course, demonstrated in table 4.8.

ILO	Quote
16	*"Too much theoretical ethics, not enough practical cases/examples"* [11.23]
18	*"We didn't cover referral letters - this would have been useful and paraprofessional communication"* [12.31]
4	*Excellent for dogs/cats/horses/cows etc but not good for rabbit, Guinea pigs, small furries, any exotics."* [12.33]

Table 4.8: Quotes highlighting areas for improvement within the highest rated ILOs

The free text responses provided explanations as to why some graduates felt less prepared in response to the lowest rated outcomes, demonstrated in the quotes provided in table 4.9.

ILO	Quote
7	*"I have required some guidance since graduation. But emergency situations are difficult to prepare for at vet school as you can't experience them all before you leave"* [11.7]
7	*"Final year rotations, having done the farm elective, included no out of hours experience of this. However, our basic teaching of emergency medicine was given."* [11.18]
15	*"Although legislation has changed since these things were being taught e.g. pet passport regulations."* [11.27]
10	*"Haven't really had much dealing with this as work in solely small animal."* [12.12]
6	*"Having been given so little case responsibility during final year rotations, this was a big leap into day one in practice - some more responsibility would ease this transition I feel."* [11.18]

Table 4.9: Quotes that explain why some graduates feel less prepared in respect to the lowest rated outcomes

Following a thematic analysis of all free text comments three themes were

identified: confidence, the course and managing the transition to practice. Graduates described being confident and also lacking confidence regarding specific skills or topics. These comments did not focus on one area but related to a range of ILOs and demonstrate individual variation in how confident they are in their own abilities. The following quotes demonstrate how two graduates feel very differently about their ability to perform clinical and surgical skills

"Very confident since starting work" [11.12]

"I did not feel very confident with my surgical skills and needed support from my colleagues." [11.1]

Graduates described their confidence in specific subject areas, for example:

"I feel farm animal nutrition and associated issues is not something I am comfortable discussing with farmers." [12.2]

They also commented on their confidence and with more generic skills:

"Need confidence sometimes when dealing with superiors" [11.12]

The second theme identified was the course. The following quotes provide evidence for specific areas of the course that graduates felt prepared them well for practice or areas that they felt needed improvement. Similar to the theme of confidence, contrasting opinions exist amongst graduates.

"I feel anaesthesia was an area which could be improved. Performing them in a more practical manner would be good." [11.7]

"Diagnostic imaging = poor" [12.15]

"Diagnostic imaging, anaesthesia and fluids excellent" [11.16]

Some comments suggest that areas of the course lack contextualisation and graduates have struggled to apply the knowledge and skills they gained to clinical practice. This quote in response to veterinary clinical knowledge illustrates this point:

"Good knowledge not enough practical practice/application" [12.15]

There are apparent deficiencies in the SVMS curriculum and graduates have relied on external resources to fill these gaps, for example:

"Although I probably learnt most about this (promoting preventative healthcare*) through private study and EMS"* [11.2]

"Limited surgical training, EMS more helpful" [12.15]

"The things I learnt about using a computer I learnt at school not from uni" [12.12]

The final theme relates to the transition from student to clinical practice. Many graduates describe this experience as stressful and challenging, for example:

"Although I feel I have been well prepared for managing the pressures and stress of life in practice, this is still something I feel all new graduates will always struggle with early in their career, no matter how much preparation they are given." [11.6]

However this is not unanimous, some graduates felt they coped well during this transition:

"Before starting my job I worried that I would not be able to cope with change, however, I have surprised myself as I have coped remarkably well." [11.1]

There was a range of levels of support that the graduates felt they required in their first job, although surgical skills was the area most frequently quoted as requiring additional support. The type of practice in which they are employed has an impact on the transition for some graduates. The following quote illustrates how some topics appear to be more comprehensively delivered in certain species areas:

"Majority of small animal diseases were well covered, however, being in mixed practice I feel some of the commoner large animal and equine diseases/conditions were not taught in sufficient depth." [11.18]

Case responsibility appears to be a significant change that many graduates struggle to cope with, demonstrated in the final quote:

"I personally have struggled with the pressure - unsure how much more Vet School could do as ultimately you are never the responsible vet as a student" [11.2]

4.3.4.2: Section 2: student assessment as preparation for practice

The clinical reasoning exam, the DOPS and the OSPE/OSCE were perceived as the best preparation for clinical practice and most relevant to the graduates' current role. PPS coursework, the portfolio and the AHW presentation were perceived as least helpful in preparation for clinical practice and least relevant to the graduates' current role. A summary of all responses to the SVMS assessments is provided in table 4.10.

The combined mean of the assessment formats was 3.68 suggesting that overall graduates felt the assessments prepared them adequately for practice and were relevant to their current role. However, there is a significant difference in the graduates' perceptions of the 10 assessment formats ($\chi^2(9) = 211.13$, $p=0.00$) suggesting that some individual assessments do not fit this description.

There was no significant difference in perception of assessment between 2011 and 2012 graduates, or between male or female respondents. When comparing graduates working in different types of practice, there is a significant difference in the perception of the clinical reasoning exam ($X^2 = 10.169$, $p = 0.017$), graduates in equine practice rated this form of assessment lower in terms of preparation for their current role, graduates working in farm animal practice rated this format highest.

Assessment	Mean	SD	Median	Minimum	Maximum
Clinical reasoning exam	4.48	0.64	5.00	3.00	5.00
DOPS	4.47	0.78	5.00	2.00	5.00
OSCE/OSPE	4.36	0.68	4.00	2.00	5.00
Research project	3.67	1.04	4.00	1.00	5.00
Spot tests	3.63	0.92	4.00	1.00	5.00
MCQ	3.58	0.71	4.00	2.00	5.00
SCT	3.37	0.96	4.00	1.00	5.00
AHW presentation	3.23	0.94	3.00	1.00	5.00
Portfolio	3.13	1.18	3.50	1.00	5.00
PPS coursework	2.89	0.78	3.00	1.00	4.00

Table 4.10: The relevance and extent to which SVMS assessment formats prepare graduates for their role in clinical practice. 5 = Excellent preparation and very relevant, 1 = no preparation or relevance.

In addition to the quantitative rating of each assessment format, the free text comments provide further detail to the graduates' perception of the way in which they were assessed. The highest rated format was the clinical reasoning exam, which graduates found both challenging and relevant to clinical practice:

"One of the few free text format exams we sat which I found more challenging and valuable." [12.13]

"Realistic cases very relevant to working in practice" [11.9]

The DOPS assessment was generally valued, however, several graduates found assessor variation a disadvantage to this format:

"Good and very relevant to job. Think there needs to be some consistency in assessments - some members of our rotation group failed certain DOPS which others passed whilst doing exactly the same thing and making the same mistakes - depended on the assessor." [12.27]

The following quote provides evidence that the DOPS can have a negative impact on learning in the clinics:

"It felt like the only times we were allowed to attempt practical things with animals on rotations was because of the DOPS and it shouldn't be that way." [12.36]

The OSPE/OSCE assessments were thought to be a good basis for learning practical skills and useful preparation for the latter stages of the course:

"Really good prep for clinical years and building confidence with practical work in all species" [12.27]

There was mixed opinion regarding the MCQ assessment format, some graduates valued this assessment for testing the course content:

"I think that MCQ's test such a breadth of knowledge that they are very good." [12.16]

Many raised concerns over the relevance to clinical practice and the impact of the MCQ exams on their learning:

"Rapid test of breadth of knowledge but not applicable to real life" [12.9]

"I found these questions examined only facts and therefore the best way to pass was to cram - but I had usually forgotten quite a lot by a few weeks later! More an exam on how good your short-term memory is" [12.7]

Although some graduates felt the SCT was a valid form of assessment, the majority of the comments describe how graduates found this format confusing, for example:

"I still do not fully understand how these are supposed to work." [11.12]

The portfolio, similar to the MCQs, received mixed feedback from the graduates. Some of the positive comments result from experience of working as a vet post-graduation:

"My opinion has changed since Vet School! I appreciate now how much importance should be placed on communication and reflective skills." [12.16]

Many of the graduates see the value in reflection, however felt the portfolio was too time consuming, at the expense of other learning:

"Very different to the PDP. Encourages reflection but in a very time consuming manner." [11.2]

Some failed to see the value in the process of completing a reflective portfolio and also questioned the reliability of the final portfolio assessment:

"The portfolio and viva is a complete waste of time - I feel the time I spent on that could have been used more effectively on revision for actual

stuff I was going to use in life. The viva mark is also very hit and miss as to which lecturers you were assessed by. There were definitely higher marks with certain lecturers than there were with others." [12.10]

The PPS coursework was the lowest rated assessment format. Graduates failed to see the relevance to their work in clinical practice, other than the business plan assessed in year 4:

"Year 4 (Business Game) was useful/relevant, otherwise generally not that applicable." [12.31]

4.3.4.3: Section 3: the graduate experience

The respondents to the survey were working in a range of different types of practice, illustrated in figure 4.6.

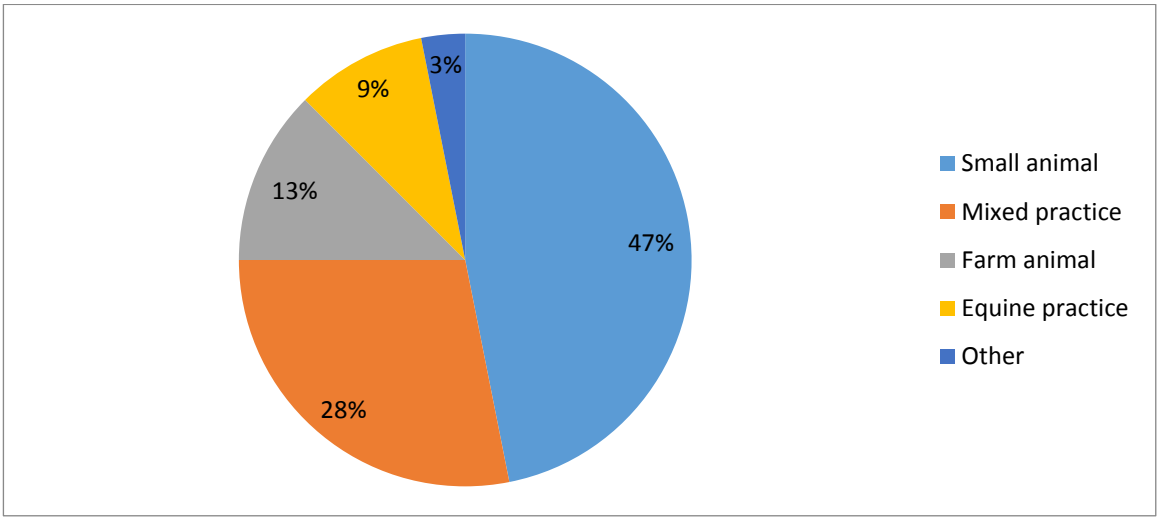

Figure 4.6: The distribution of graduates working in different types of practice.

Most graduates (87.5%) felt that their experience of work had matched up to their expectations. 36.5% of graduates stated that their eventual choice of work had been influenced by the Nottingham course and 95.2% of graduates would still study veterinary science at Nottingham if they

could repeat their time at university. These results are shown in figure 4.7.

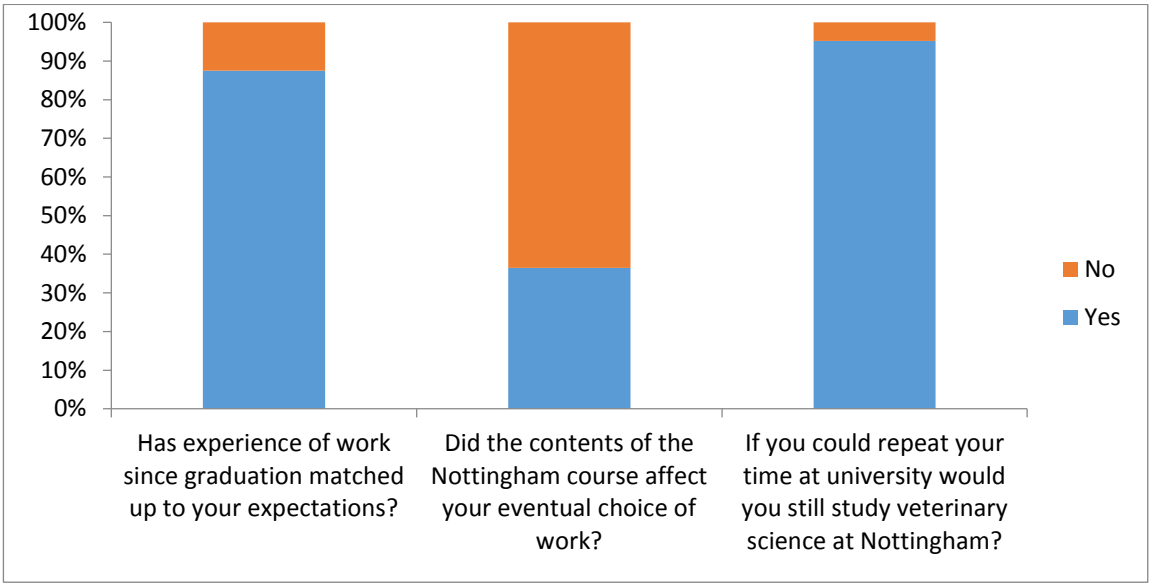

Figure 4.7: Responses to 3 questions about the SVMS graduate experience

The free text comments in this section summarise the graduates' opinions about their overall experience at SVMS and are generally positive. The minority who stated they wouldn't choose to study veterinary science at Nottingham implied this was due to their experience of working as a vet rather than the Nottingham course:

"If I studied veterinary, I would still pick Nottingham" [11.2]

And whilst there are areas in which improvements need to be made, the course is thought to be good preparation for practice:

"I don't think the course was perfect but speaking to graduates from other courses we were much better prepared at Nottingham - Thank you!" [11.9]

4.3.4.4: Undergraduate attainment and preparation for practice

This final section reports the results of the correlation between undergraduate attainment and the graduates' perception of their preparation for practice. There was a significant negative correlation between ILO 2, veterinary clinical knowledge and BVMedSci performance ($r = -0.256$, $p = 0.050$); ILO 4, clinical examination skills and BVMedSci performance ($r = -0.294$, $p = 0.024$). There was a significant positive correlation between ILO 8, promoting preventative healthcare and portfolio performance ($r = 0.260$, $p = 0.045$); ILO 13, recognizing own limitations and seeking help and advice where needed and portfolio performance ($r = 0.251$, $p = 0.054$); ILO 21, flexibility and ability to cope with change and SCT performance ($r = 0.307$, $p = 0.017$).

There were no other significant correlations between undergraduate performance and perceived preparation for practice, however several patterns could be identified and are illustrated in table 4.11. There were more positive correlations between preparation for practice and performance in the portfolio than any other assessment format. Veterinary specific ILOs were more negatively correlated with undergraduate performance, whereas more generic skills were more positively correlated.

ILO	BVMedSci	BVMBVS	MCQ	SCT	Portfolio
Knowledge of basic science					
Veterinary Clinical Knowledge	*r= -0.256				
Clinical and surgical skills					
Clinical examination skills	*r = -0.294				
Diagnostic reasoning abilities					
Case management and therapeutics					
Emergency and critical care cases					
Promoting preventative healthcare					*r = 0.260
Population health and epidemiology					
Veterinary public health & zoonoses					
Implementation of euthanasia					
Veterinary practice management					
Recognising own limitations					*r = 0.251
Seek and utilise new information					
Knowledge of veterinary legislation					
Application of ethics to animal					
Professional responsibilities					
Communication skills					
Interpersonal and teamwork skills					
Robustness					
Flexibility				*r = 0.307	
Maintaining a work life balance					
Problem solving and critical thinking					
IT skills					
Research skills					
Overall competence					

Table 4.11: The relationship between undergraduate attainment and perceived preparation for practice with respect to each of the ILOs. Positive correlations are shown as green, negative correlations as red and the blank cell represents a correlation of 0. R-values are included for any significant correlations.

4.3.5: Overview and implications of chapter 4

The first step in the investigation of CA within the curriculum was to define the ILOs of the SVMS veterinary course. This involved a systematic review of the literature and SVMS staff focus group. The 25 ILOs identified were then validated using a staff survey. The ILOs were expressed as attributes or skills for the purpose of the outcomes assessment. This does not conform to previous instruction on writing learning outcomes (Spady, 1994) but is more consistent with published OA in veterinary medicine (Walsh et al., 2001, Mellanby et al., 2011). The ILOs were closely aligned to the existing learning outcomes within the programme specification.

The ILOs were used within section 1 of the graduate survey. This section had high internal consistency (alpha > 0.7) which shows the items are interrelated with low measurement error. The alpha value for section 2 was lower than 0.7, which suggests the items are less well correlated, but is also attributable to fewer questions in comparison to section one.

Generally graduates felt well prepared for their roles in clinical practice with respect to the 25 ILOs and this is consistent with other studies of veterinary graduates within the UK (AVS, 2012, MORI, 2013). Although graduate perception is not a direct measure of ILOs, these initial results suggest that curricular alignment exists to a certain extent. Areas for potential improvement within the curriculum were identified, consistent with the purpose of OA (Kochevar, 2004, Trent, 2002). This information has been fed back to module convenors and teaching providers, thereby completing the cycle and ensuring that the OA fulfils its purpose of curriculum evaluation and improvement.

There were some differences between the ratings for graduates working in different types of practice. This is perhaps not that surprising considering the varied nature of clinical practice including the provision of out of hours care, the nature of the clients and the amount of time spent working alone away from the practice in large animal work. The challenges associated with transition to different types of veterinary practice could be an area for future investigation.

Some graduates lacked confidence in specific areas although this is not entirely consistent with the findings of previous studies where graduates have been found to be lacking in areas such as communication, interpersonal skills and business awareness (Routly et al., 2002, Danielson et al., 2012, Doucet and Vrins, 2010). In contrast the SVMS graduates rated their preparation in communication skills, teamwork and professional responsibility very highly. Consistent with previous studies (Garrett, 2009), for the participants in this study, one of the most challenging aspects of working as a newly qualified veterinary surgeon is case responsibility. The SVMS course had not completely prepared them for practice in this respect. However this is problematic for all veterinary courses, as during undergraduate clinical placements responsibility for each case seen will ultimately lie with a qualified veterinary surgeon and not the student. There is therefore a need for novel methods of delivery and assessment that require the student to make decisions regarding diagnoses and clinical case management, where there are real consequences to their actions but no compromise to animal welfare. The use of high-fidelity simulation has been used to this effect within medical education (Gordon et al, 2001, Barry Issenberg et al, 2005) and should be

considered as a potential strategy for enhancing clinical decision-making amongst veterinary students.

To achieve CA within a curriculum assessment methods must be considered alongside delivery and course content. Graduates rated authentic assessment methods, which require students to perform clinical skills or answer questions in the context of clinical cases, highest for preparation and relevance to their current role. Concerns were raised over the MCQ format that drives a surface approach to learning for some students and the purpose and format of the SCT was reported to be confusing. These results suggest that alignment of the assessment with the rest of the curriculum and ILOs has not been optimally achieved. The SCT and MCQ formats will be the subject of investigation in studies 3 and 4 in the next chapter.

The portfolio was one of the lowest rated assessment formats, contrary to previous studies which have shown the portfolio to be a valid and student centred method of assessing clinical competence (Driessen et al., 2005). However, there appears to be an increased appreciation of this format post-graduation following a period of time in practice. Furthermore the relationship between portfolio performance and perceived preparation for practice is a positive one. These results do not provide direct evidence of high attainment in the portfolio directly resulting in an increased preparation for practice. However, these preliminary data suggest that the portfolio may have a different educational impact to the other assessment formats within the study and this warrants further investigation.

Negative correlations were found between many of the veterinary specific ILOs and undergraduate attainment. This may be due to problems previously identified with self-evaluation studies (Doucet and Vrins, 2010, Woolliscroft et al., 1993) and other measures of performance in veterinary practice would provide useful comparative data. Alternatively this relationship may be another indicator that alignment of SVMS assessment methods could be enhanced so that high attaining students are genuinely better prepared for the challenges of clinical veterinary practice.

In summary, graduates feel well prepared for practice and on the whole are satisfied with the SVMS course. However, elements of the assessment strategy do not appear to be aligned with the ILOs of the course. Some of these elements, namely MCQs, DOPS and the SCT, will be investigated further in chapter 5.

Chapter 5: The Educational Impact of Assessment on Final Year Students

The outcomes assessment exercise in chapter 4 identified areas of the SVMS assessment strategy that were not aligned with the rest of the curriculum and the ILOs of the course. This included the use of the MCQ, which was often perceived as testing recall of information and the SCT which many graduates found confusing. Both the MCQ and SCT formats were rated lower than DOPS as preparation for clinical practice and these formats are the focus of the research within this chapter. The educational impact of other components of the SVMS assessment strategy has not been investigated within the thesis as the decision was made to focus on the final year and transition to practice. The results from chapter 4 suggest the educational impact of the portfolio assessment may differ from other assessment methods. The portfolio assessment is unique in that it is used to different effects within different educational settings. Within the SVMS the aim is to assess professionalism and the portfolio assessment does not focus on other areas of clinical competence. There has been an increase in the delivery and assessment of professional skills within recent years in veterinary curricula (Bonvicini, 2010, Mossop and Gray, 2008, Hecker et al, 2012). However, assessment of professionalism, including associated attitudes and behaviours, is controversial and challenging (Hodges et al., 2011, Mossop and Cobb, 2013). Furthermore the format and guidelines on the use of the SVMS professional portfolio have changed significantly since the School began in 2006. For these reasons it was decided that assessment of professionalism, a complex

entity which is not a specific focus for this research, would not be investigated further within this thesis.

The aim of the studies reported in chapter 5 was to develop a greater understanding of the educational impact of these assessment methods by answering research question 3:

3. What is the impact of assessment methods, used in the final year of study in veterinary medicine, on learning behaviour?

The impact these assessments have on learning behaviour will enable us to establish a better understanding of their effects on CA within the curriculum. Firstly, section 5.1 describes study 3, a comparison of the educational impact of the MCQ exam and DOPS. In section 5.2 the student perception and impact on learning behaviour of the SCT is investigated. Figure 5.1 illustrates where both of these studies fit within the overall research plan:

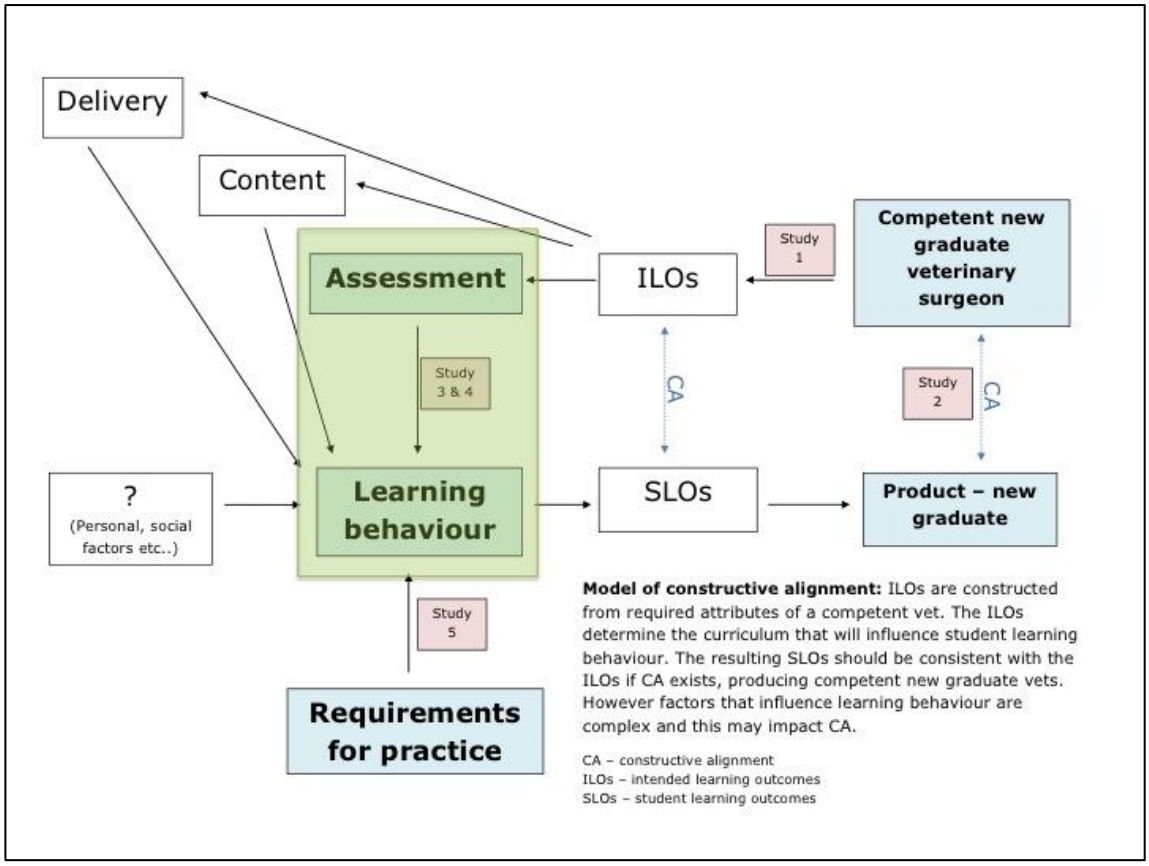

Figure 5.1: A model of constructive alignment highlighting studies 3 and 4: the impact of SVMS assessment on learning behaviour.

5.1: Study 3: The educational impact of assessment: a comparison of workplace based learning and multiple choice question formats.

5.1.1 Introduction

Students' approach to learning has been discussed previously (chapter 2) as a flexible entity that changes in response to a variety of contextual factors. The aim of study 3 is to investigate the extent to which assessment format influences approach to learning in final year students. Two contrasting assessment formats have been selected: the MCQ, which is used to test knowledge and is completed online by students at the

SVMS and DOPS, a form of WPBA where students are assessed on their practical ability in the context of real cases. The Study Process Questionnaire (SPQ) (Biggs, 1987b) was chosen for the initial measurement of student approach to learning in response to the two formats. The SPQ identifies three approaches to learning, deep, achieving and surface approaches. Further details of the motivations and learning strategies associated with each approach are provided in chapter 2. Justification for the use of the SPQ has been discussed previously in chapter 3. The relationship between approach to learning and exam performance is also reported. This is followed by a qualitative analysis of student interview data to provide a more in depth understanding of students' motivations and behaviours in response to the MCQ compared to the DOPS assessments. Looking more closely at the effects of the MCQ and DOPS formats on students' approach to learning will enable a greater understanding of the impact of these assessments on CA in the curriculum.

5.1.2: Methods

5.1.2.1: Data collection

An online survey was sent to all (87) students in the final year of the veterinary medicine course in April 2011. The survey was a shortened, 18 item, version of the SPQ previously validated in a study of over 1300 medical students across five different universities within the UK (Fox et al., 2001). The questionnaire was piloted to check meaning in the context of a course in veterinary medicine, the final version sent out to students is included in appendix 7. Participants answered each item twice: once in

preparation for the MCQ examination (the finals examination) and once in preparation for the DOPS (study during rotations). Optional free text response boxes for were included for students' comments. The responses were collected using SurveyMonkey™ (http://www.surveymonkey.com).

Within the survey, students were also asked if they would be willing to participate in an interview, 34 students agreed to participate, of which a purposive sample of 19 were invited to interview and 16 students attended. Students were selected so that participants reflected the overall gender balance and rotation experience within the year. Face to face, semi structured interviews were conducted in person to allow in depth exploration of the student perception of assessment and the mechanism of impact on their learning. The questions used to generate discussion within the interviews are included within appendix 8. Each interview was recorded with a digital voice recorder and transcribed verbatim. The interviews typically lasted between 30 minutes and 1 hour. All survey and interview participants were offered an incentive for participation.

5.1.2.2: Data analysis

The results of the SPQ were analysed using SPSS version 17. Internal reliability coefficients (Cronbach's alpha) were calculated for the three approaches to learning. In addition correlation coefficients (r) between the MCQ and DOPS for each approach to learning were calculated (Donnon and Hecker, 2008). The Wilcoxon signed ranks test was used to compare approach to learning scores between DOPS and the MCQ examination and an effect size estimate, *r*, was calculated. A Spearman's rho correlation coefficient was calculated to determine the relationship between approach

to learning score and academic performance in the MCQ examination at the end of their 5th year; this could not be repeated for the DOPS as the assessment format used in this context does not generate a numerical score.

The qualitative data were analysed using thematic analysis (Braun and Clarke, 2006) with the aid of the computer assisted qualitative data analysis software, QSR International NVivo version 9, (2010). A deductive approach was used, applying a theoretical framework to identify pre-determined themes based on student approaches to learning as described by Biggs (1987a). In addition to the *a priori* codes used initial codes were also identified using inductive analysis. Collaborative coding of three transcripts by a second researcher resulted in an iterative review process until the code structure was agreed and then applied to the remaining data set (Saldaña, 2009). The pre-determined and initial codes were then grouped into over-arching themes.

5.1.3: Results

A total of 70 students completed the shortened study process questionnaire with respect to both MCQ and DOPS; this represented a response rate of 80.5%. Of those, 6 students chose to remain anonymous and were not therefore included in the comparison of study approach to exam performance.

5.1.3.1: Internal Reliability

The internal reliability (Cronbach's alpha) for all 18 items of the shortened SPQ was .64 for MCQ and .69 for DOPS. The Cronbach's alpha values for the three study approaches ranged from .35 to .72 and the correlation

coefficients (r) for study approaches between MCQ and DOPS ranged from .57 to .70 (table 5.1).

	Reliability Cronbach's alpha (α) MCQ	**Reliability Cronbach's alpha (α) DOPS**	**Spearman's rho correlation coefficient r(MCQ, DOPS)**
Surface Approach	.35	.43	.57**
Deep Approach	.62	.72	.60**
Achieving Approach	.51	.56	.70**

Table 5.1: Internal reliability and correlation coefficients for study approach scores for DOPS and MCQ
** Correlation is significant at the 0.01 level

5.1.3.2: Study approach scores for DOPS compared to MCQ examination

There were significant differences between deep and surface approaches to learning for the DOPS and the MCQ; however the achieving approach did not differ significantly between the two formats. The mean average score for deep approach to learning was higher for DOPS compared to the MCQ. Whereas the average score for surface approach to learning for DOPS was lower than for the MCQ. A summary of the approach to learning scores for the DOPS and MCQ is provided in table 5.2.

	DOPS average scores		MCQ average scores		Wilcoxon Signed Ranks Test (z)	P value	Effect size (r)
	mean (SD)	**median** (IQR)	**mean** (SD)	**median** (IQR)			
Surface approach	14.5 (2.81)	14.0 (7.0)	16.2 (3.06)	18.0 (7.0)	-5.048	.000**	-.44
Deep approach	19.4 (4.12)	19.0 (5.0)	18.0 (3.73)	18.0 (5.0)	-3.299	.001*	-.28
Achieving approach	15.1 (4.3)	15.0 (6.0)	15.3 (4.09)	15.0 (5.0)	-.830	.406	-.07

Table 5.2: Study approach scores for DOPS compared to MCQ
IQR = interquartile range; SD = standard deviation
*P<0.01, **P<0.001

5.1.3.3: Academic performance and approach to learning

There was a significant positive correlation between performance in the MCQ examination and an achieving approach to study, r= .31, p= .014. No further significant correlations were found between performance in the MCQ examination and approach to study. Similarly there were no significant correlations between approach to study for the DOPS and performance in the MCQ examination. These data are presented in table 5.3.

	Spearman's rho correlation coefficient between study approach and year 5 MCQ examination performance	
	Study approach for MCQ	Study approach for DOPS
Surface Approach	-.07	-.01
Deep Approach	.18	.11
Achieving Approach	.31*	.24

Table 5.3: The correlation between approach to learning for both the MCQ and DOPS assessment formats and MCQ examination performance
*P<0.05

5.1.3.4: Qualitative analysis of student interview data

Two related overarching themes were identified from the qualitative data analysis: the effects of the MCQ and DOPS on approach to learning and factors that influence learning behaviour. Within the first theme, effects of the MCQ and DOPS on approach to learning, *a priori* codes were formed to identify deep, surface and achieving learning strategies. In addition the impact of the DOPS on experiential learning was described. The second theme arose mainly following inductive coding where factors influencing approach to study were identified in the data. Motivation, for which *a priori* codes were assigned, was also included within the second theme. Table 5.4 provides a summary of the two main themes and their constituent sub-themes resulting from the qualitative analysis. The examples of quotations from students are referred to as Q1, Q2, etc. Students are referred to by gender and number, for example F1, M2, etc.

Factors Influencing study behaviour	Effects on study behaviour
Motivation*	Deep strategy*
Purpose	Surface strategy*
Consequence	Achieving strategy*
Acceptability	Experiential learning approach
Feedback	
Time pressure	
Student variation	

Table 5.4: A summary of the themes induced and deduced from the qualitative data. * Deduced themes from Biggs' model of approach to learning (Biggs, 1987).

Theme 1: The effects of the MCQ and DOPS on approach to learning

Deep, surface and achieving learning strategies were identified from the discussions with the students. They are presented here in association with the two assessment formats. The impact of DOPS on experiential learning is also discussed.

The DOPS were thought to encourage a deep learning strategy. Q1 illustrates this deep approach to learning during clinical rotations:

Q1 *"It's not so much sitting down with a book and learning it from scratch, but I think for most people it's trying to relate everything you see*

when you see practice on rotation, to what you know and build on it and go and look up what you are not sure about." [F2]

In preparation for DOPS students endeavour to develop an increased depth of understanding, evident in Q2:

Q2: *"I had equine anaesthesia DOPS, because I felt the need to go and read everything there was about equine anaesthesia to make sure I was going to get that right"* [F7]

The provision of a list of tasks for the DOPS increased the breadth of study. Rather than learning only for their assigned assessment task, some students used the entire list as a set of objectives to achieve before graduation (Q3).

Q3: *"but at the same time, because they're very defined tasks, you have to make sure you include the whole group of DOPS and not just the one you're assessed on"* [F2]

The MCQ format was more commonly associated with surface strategies. Students are aware that this is not best practice for constructive learning which will aid their development as a practitioner. However, they described adopting surface strategies in preparation for the MCQ examination, as this was deemed necessary to be successful (Q4 and Q5).

Q4: *"I hope I retain the key things, but a lot of the little detail, no I'll forget very quickly because of the way you have to revise for the exam,*

you've got two weeks right before them to try and cram it all in so that you can click the right box" [F3]

Q5: *"I thought I'm not sure if this is benefiting me cos I'm shoving so much into my brain each day that actually I think it's just pushing stuff out, whereas if it had been maybe a bit more spread out or a bit less, I would have actually benefited from it more"* [F4]

For some students this provides a conflict between the way in which they want to study and the strategies they feel they need to adopt to be successful; this was sometimes perceived as unfair, as described by the student in Q6:

Q6: *"I think at the moment it sort of biases towards people who can absorb facts, absorb facts, absorb facts, and then spew it out for a week of assessment, rather than sort of testing the more rounded sort of characteristics of an individual and a sort of deeper understanding of the material"* [M4]

In contrast with the MCQ, DOPS was rarely associated with a surface approach. But a surface strategy was occasionally used to prepare for DOPS when there was a lack of opportunity to complete the assessment tasks in the time available in clinics. In Q7 the student describes how DOPS drove her to adopt a surface approach due to perceived lack of time and opportunity.

Q7: *"I would just go and cram for it and just try and get any exposure to that skill if I hadn't had much exposure to it until I did the DOPS. It was sheer panic. It really was. I can't describe how scared we were that we weren't going to get them done. That's the only thing we thought about. On a Monday morning when you started rotations, am I going to get a DOPS, am I going to get to do it. That really drove us. But then having said that, the last two or three rotations, cos we'd finished, we got them all done by end of March, we actually really relaxed and we had more time to sit and learn about the cases we'd seen and chat about the cases"* [F11]

Examination success is obviously important to students and in preparation for both MCQ and DOPS they described a change in learning behaviour to achieve maximum success. However, the ways in which these behaviours manifest was different for each format. For the MCQ exam an increase in surface strategy techniques was reported (Q4 and Q5) and a decrease in deep learning strategy (Q8)

Q8: *"I always start my revision as I should mean to go on, which is sort of going through things in-depth and trying to understand them. Inevitably I run out of time and have to resort to flicking through lectures and skim-reading things. Often I have found that that is a terrible policy I know, and it won't serve me in the long-term, it's got me a lot of extra marks because I'll recognise a picture from a lecture on an exam and it'll just be in my extremely short-term memory. And I know that that can work for me here. Obviously I'm going to do that before an exam cos I know it*

might get me the marks, but I don't feel happy that that's the way I'm learning" [F10]

The influence of DOPS on learning behaviour was often seen in their strategic manipulation of the system (Q9). This achieving strategy was recognised but not adopted by all students; resulting in a feeling of resentment and the perception that students who 'play the system' are at an unfair advantage.

Q9: *"I'll be honest, I did tactically pick certain DOPS so they could only fall on certain rotations. And I tactically picked the easier DOPS out of different skill areas, cos that's just sensible. You don't do a bitch spay if you can do an FNA* (fine needle aspirate) *do you"* [M5]

The students in this study are required to pass the MCQ examination in each of three different species areas. Their preference for working within one particular field often led to an achieving strategy (Q10).

Quote 10: *"cos I'm interested in small animals, whereas with equine and farm, sometimes I might not be quite aware of all the important things. So I'd ask other people about it, just sort of discuss with each other what the important diseases were, and really focus on those and make sure I have a good understanding of those, and then everything else comes as sort of a bonus"* [F4]

The students described situations where the DOPS enhanced their experiential learning in the clinics by providing a focus for a rotation,

increasing dialogue between clinicians and students and through encouraging students to seek opportunities to practise skills (Q11).

Q11*: "cos I think you always have a tendency, especially when there's not a lot going on, to just almost phase out and just see stuff and just watch it go through. Or you watch a skill and someone doing something or you do it yourself, but you don't think how exactly you do it and make a note. But then when you get into the DOPS where you've got to follow the steps and get it right, it really sort of makes you think can I do all the steps. Yeah it really changes the way you look at the sort of skills.... it just kind of enhances your approach to it"* [M1]

However, for some DOPS placed an emphasis on skill acquisition at the expense of knowledge. In Q12 the student describes how his clinical skills have improved during the year driven by the DOPS assessment:

Q12: *"cos I feel my knowledge has sort of waned over final year. My skills have sort of improved but my knowledge has waned compared to fourth year in some areas, like the areas that you don't really need to know that much, and then those areas were still tested in finals, which is fine. I just think if you'd have been tested as you went along every rotation, tested on your knowledge, you'd have learnt as you went along rotations"* [M5]

The impact of DOPS is not always positive, for some students DOPS can provide too much of a focus and appears to limit experiential learning (Q7). Students occasionally described the staff as concentrating on assessing DOPS at the expense of clinical teaching. In Q13, the student

describes her experience of being assessed on collecting and analysing a urine sample:

Q13: *"So you tore yourself away from something interesting to go get a urine sample cos you wanted to practise cos you really wanted to pass. Yet there's going to be a hundred chances to get a urine sample, but they might be doing something really interesting over there. It was a bit of a hard dilemma cos you felt like it shouldn't be the focus, but yet at the back of your mind you think I've got to pass this so I need to practise it, and if they're going to give me a chance to practise, I'm definitely going to do it"* [F9]

Theme 2: Reported influences on approaches to learning

Analysis of the transcripts revealed several factors which influenced participants' learning behaviour (table 5.4). These influencing factors are discussed in theme 2:

Motivation: The students in this study demonstrated a deep motivation to learn as a result of their desire to become a 'good vet' and provide the best service to their clients and ensure the welfare of animals in their care. In addition some described deep, intrinsic motivation to learn for their own satisfaction and a 'love of learning' (Q14)

Q14: *"learning is something I fully enjoy and I just like to challenge myself and keep moving forward. So I suppose it's important as a vet, but for my point of view it's probably even more important as a person"* [F2]

Generally, there was little evidence of surface motivation from the student interviews, although this is apparent in the lead up the end of year exams (Q15).

Q15: *"We were saying earlier that the things we've been learning in fifth year are good for going into practice. Well I was learning them so I've got them in practice, but I was also learning them because I was scared of failing, especially when we come up to finals. My revision leave was purely and simply so I did not fail cos I was so scared of failing and not graduating with my mates"* [F11]

Some also described a competitive element associated with the final examination. This achieving motivation is demonstrated in Q16.

Q16: *"it gives you feedback about your own performance and your own understanding, knowledge and whereabouts you are, especially whereabouts you are in the year. I think that's quite important cos we're quite a competitive year"* [F11]

For others motivation to learn comes from their own personal gain and the satisfaction of high attainment (Q17).

Q17: *"I don't think I've ever failed an exam and I've always wanted just to get the best out of what I do. I think I've always done well. To then not do well is just sort of self-failure [laughs]. Just a personal thing"* [F7]

Purpose of assessments: There was an ongoing conflict between learning for the assessment and learning to be a competent practitioner. Some students discussed the emphasis changing towards the end of the course

as they realised that becoming a competent clinician is more important to them than their examination results. However, they have to overcome the assessment hurdle and this still had a large impact on their learning strategies. Students perceived the MCQ to be testing knowledge that relies on recall of facts resulting in an increased surface strategy (Q4, Q5 and Q6). In contrast DOPS were seen as an assessment of competence and also encouraged reflection for some students, illustrated in Q18.

Q18: *"I think they* (DOPS) *are generally a good way of assessment. I think it does make you think about what you need to know and certainly you sort of get used to saying whether you're competent or not and then that kind of transfers to other skills and you sort of think well can I do this, could I do it on day one"* [M1]

Consequence of the assessment: It has already been shown that the participants considered that high stakes assessment encouraged a surface approach to learning (Q4 – Q8). Where the stakes were perceived to be lower, a deeper and more reflective approach was apparent (Q1 – Q3 and Q18). DOPS had additional consequences that impacted on their approach to learning: case responsibility promotes a deep motivation to learn and face-to-face interaction with an assessor (Q19).

Q19: *"If you know a vet's going to quiz you, you'll spend much more time looking stuff up. If you know they're not going to ask questions, inherently human nature's not to look so much stuff up, and it probably shouldn't be the way, but invariably it is"* [M1]

Acceptability: Students reported that DOPS were an acceptable way of assessing clinical skills in comparison to other assessment formats (Q20).

Q20: *"I'm quite okay at practical skills, but OSCEs, you just get so stressed and your hands are shaking, I don't think it's a very realistic way of kind of assessing practical skills really. I think that DOPS do that a lot better because it's in a real setting, you know, probably the best way of doing it. An MCQ I don't think particularly represents what we're going to do when we're out there in practice, because you don't have an option of four things to choose from"* [F3]

However the variation they experienced with DOPS was less acceptable. For some students the variation in difficulty of tasks (Q9) and tutors (Q21) was perceived as unfair and appeared to detract from their learning experience.

Q21: *"I think there are certainly people who you want to be examining your DOPS and there are people who you have a heart sink. When you see them come in, in the morning, you think oh god, I hope my DOPS is not today"* [M3]

Feedback: Participants appreciated the regular opportunity for face-to-face feedback following a DOPS. Although a minority described interactions with clinicians as stressful, generally feedback helped them to improve (Q22) and boosted their confidence (Q23).

Q22: *"and he discussed with me where I needed to improve and so made me feel a lot better about it cos you can see why you failed and work out how to improve, and it just all seems quite achievable then"* [F4]

Q23: *"I got quite positive feedback and it gave me a real boost actually cos as I said, PDSA was my first rotation, and it really boosted my confidence going into the next one thinking yeah maybe I can do this. So that was really good"* [F3]

Time Pressure: This factor was identified as having a major impact on learning behaviour; it was instrumental in determining whether students were allowed to adopt deep learning strategies aligned with their motivations or whether they were forced to utilise more surface strategies which they recognised were not beneficial to their development as clinicians. For some students time pressure was essential for motivation and to ensure efficient learning strategies but Q4 – Q8 and Q24 demonstrate how time pressure affected many students by increasing stress levels and often driving them towards a more superficial approach to learning.

Q24: *"Yet in two weeks there's just no time. It was awful to think you hadn't even covered everything. You were going into exams and you hadn't read some of your lectures"*

In contrast to the MCQ examination, time pressure for DOPS was less of an issue for most students. In Q25 the student describes how DOPS allowed her to develop a deeper more reflective approach.

Q25: *"I think with the DOPS, if you fail one, you have the time to, you know, pass 2 more in the group and get the group done, you know, and think about it build on it and reflect on okay, why did I fail. And that's, in my opinion, very good, because it gives you time to use that experience*

and build on it, and you know, rather than one big practical exam at the end" [F2]

Student Variation: Both the MCQ and DOPS assessments influenced student learning to some extent. However, these effects were not uniform across the participants. Q26 – Q29 demonstrate the differential effects of DOPS on experiential learning:

Q26: *"the first eight months of the year I was so obsessed with DOPS, that's the only thing I could think about"* [F11]

Q27: "*if you had a DOPS that needed doing, you might get to the last day of rotation and you would hunt down a case that you could do that on and you might potentially miss out on what you'd normally do"* [M2]

Q28: "*because you have one DOPS per rotation, if that, and you know, it's quite a limited amount of work that I would ever have done for a DOPS. No. I don't think it took anything away from my time or from my experience generally"* [F10]

Q29: "*I think the DOPS were more of a I've just got to get it done kind of thing. Yeah I think they were just things that you just had to tick a box"* [F6]

5.1.4: Overview and implications of study 3

This study has highlighted differences in approach to learning between two commonly used assessment formats: the MCQ appears to result in a more surface approach compared to DOPS where deeper learning strategies are described. In chapter 4 it was found that SVMS graduates perceived the DOPS to be good preparation for clinical practice and relevant to the role of a veterinary surgeon. In addition, it can now be concluded that the DOPS can promote a deep approach to learning for final year students on rotations. Findings from both studies provide evidence for DOPS as an authentic assessment format that is aligned with the SVMS curriculum and the expected learning outcomes for veterinary graduates. Despite the use of the DOPS as an *assessment of learning* in this context, several features of the DOPS format promoted desirable learning strategies, consistent with *assessment for learning* as described by (Black and Wiliam, 1999, Schuwirth and Van Der Vleuten, 2011a). The DOPS have high face validity; provide regular opportunity for increased dialogue between students and clinicians; generate feedback that can increase students' confidence and promote reflective practice and self-evaluation.

In contrast, students perceive the MCQ examination to be testing large volumes of knowledge with insufficient time to prepare. Similar findings are reported by Scouller (1998) and Tang (1994) and these quantitative perceptions of assessments lead to the use of surface learning strategies which are neither aligned with curricular philosophy nor the motivations of the students. However, the students' perception of the assessment format

is just one component contributing to the complex relationship between assessment and learning.

Other assessment related factors that influence the learning behaviour of final year students have been identified in this study. For these students, motivation should not be underestimated. They are deeply motivated to become competent and caring veterinary practitioners and to a certain extent will employ a deep approach to their learning regardless of any assessment strategy. However, there are other factors that appear to interact with their motivations and personal learning preferences thus influencing their overall approach. Consistent with the findings reported by Cilliers et al. (2010) the consequence of an assessment is an important influential factor in the learning behaviour of students in this study. The consequences of high stakes assessment can provide a powerful driver for learning but the educational impact is not necessarily a positive one for all students. Where students perceive the consequences to be lower stakes, a deeper approach is often adopted and formative assessment is used to its maximum effect (Nicol and Macfarlane-Dick, 2006).

The impact of increasing time pressure on student learning is invariably negative; eventually an assessment task becomes no longer manageable without a change of strategy. Surface strategies are therefore utilised at the expense of the deeper learning to overcome the assessment hurdle. Similar findings have been reported in medical students (Cilliers et al., 2010) where their approach to learning becomes a requirement for success imposed by the assessment system rather than a personal choice.

If CA exists within a curriculum the employment of a deep approach to learning should result in enhanced performance and attainment of the course ILOs. Positive correlations with performance and a deep or achieving approach have been observed in other studies (Brown et al., 2003, Donnon and Hecker, 2010, McManus et al., 1999). Although many students reported the use of achieving strategies that they perceived resulted in higher marks and a positive relationship was observed between achieving approach and performance, no firm conclusion can be made due to the lack of validation of the SPQ in this context. However, these data suggest that assessment is not optimally aligned within the SVMS curriculum as students adapt their approach to learning to ensure success in examinations.

The reliability of the SPQ did not meet minimum requirements ($\alpha > 0.7$) in this study. Furthermore there were too few participants to provide any proof of validity using confirmatory factor analysis. For these reasons motivation and strategy scores were not used, only the combined approach to learning score was used in the analysis. Although this version of the questionnaire has been previously validated in medical students (McManus et al., 1998) its use in the present context requires further investigation. The full version of the SPQ may be more appropriate for the evaluation of the sub-scales on small sample sizes. The results of the SPQ should therefore be interpreted with caution, but they have proved useful preliminary data to inform the qualitative investigation in this study.

The data were collected over a 4-week period at the end of the final year of study and therefore represent a snapshot of the students' opinions

regarding assessment and learning behaviour. As time pressure was identified as a major influence on the educational impact of assessment, a longitudinal study would be beneficial to explore changes in attitudes and approaches to assessment throughout the year. Despite these limitations this study provides useful information regarding the educational impact of the MCQ and DOPS formats in this context.

In conclusion the mechanism of the impact of assessment on learning behaviour is complex. The MCQ and DOPS formats have been shown to have differing effects on students' approach to study. However this may be due to the student perception of the requirement for the assessment in a given context and not the format *per se*. Section 5.2 reports the results of an investigation into the student perception of a novel assessment format, the SCT, in the context of veterinary education.

5.2: Study 4: The students' perceptions of the Script Concordance Test and its impact on learning behaviour

5.2.1: Introduction

The SCT, previously discussed in chapter 2, is a novel format that has been developed to test clinical reasoning in medical education. Although there is evidence to support the validity and reliability of the SCT (Lubarsky et al., 2011) little is known about its educational impact. Clinical reasoning skills are integral to the role of a veterinary practitioner and are included in the ILOs defined in chapter 3. Therefore the SCT, as an assessment of clinical reasoning, should be aligned with the SVMS curriculum and promote learning strategies that enable students to achieve these ILOs. However, there is scant evidence to support its use within veterinary education and the final year is the first time these students are exposed to this unique assessment format. The students' perceptions of the test and the consequences on their learning behaviour were studied to gain a better understanding of how well aligned the SCT really is within the context of the SVMS curriculum. Their opinions were collated during focus group discussions following formative SCT assessments. These opinions were subsequently used to inform the design of a questionnaire that was delivered to all participants.

5.2.2: Methods

5.2.2.1: Delivery of the formative SCT

An email was sent to all final year students inviting them to participate in the study in May 2012 (appendix 9). Volunteers were sent a link to three online SCT papers (appendix 10) that were available to students during

their final year, in addition they were provided with instructions on how to complete the SCT and example questions (appendix 11). Participants were able to access the assessments in their own time with access to online and textbook resources. They were informed that the assessment was formative, the results would remain anonymous and would not contribute to their final year degree mark. Each assessment contained between 20 and 24 questions including small animal, equine and farm animal cases. The assessment was delivered through the University of Nottingham online assessment system, Rogo; an example SCT question from the Rogo system is provided in Figure 5.2.

On completion of each assessment, the students were directed to a feedback screen where the responses from the panel could be seen along with the student score for each question. In addition to the quantitative responses feedback was provided in the form of qualitative comments from the panel collected during the development of the SCT. Figure 5.3 provides an example of the information received on the feedback screen.

The first assessment was completed during July 2012; the second assessment was released to students in November 2012 and at this time a second email was sent to all final year students inviting them to participate in the study. The third assessment was released to students in April 2013, again an invite was sent to all final year students allowing those who hadn't signed up to the study access to the formative SCT papers.

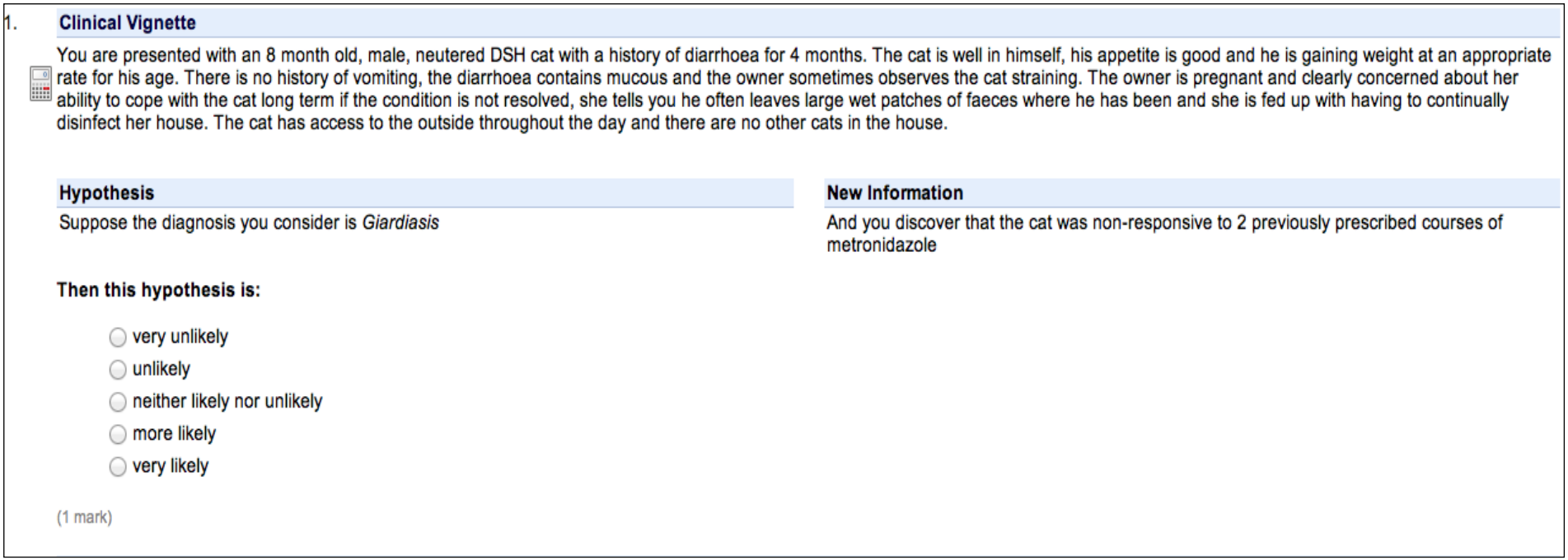

Figure 5.2: The layout of the SCT question as seen by the students in the online assessment.

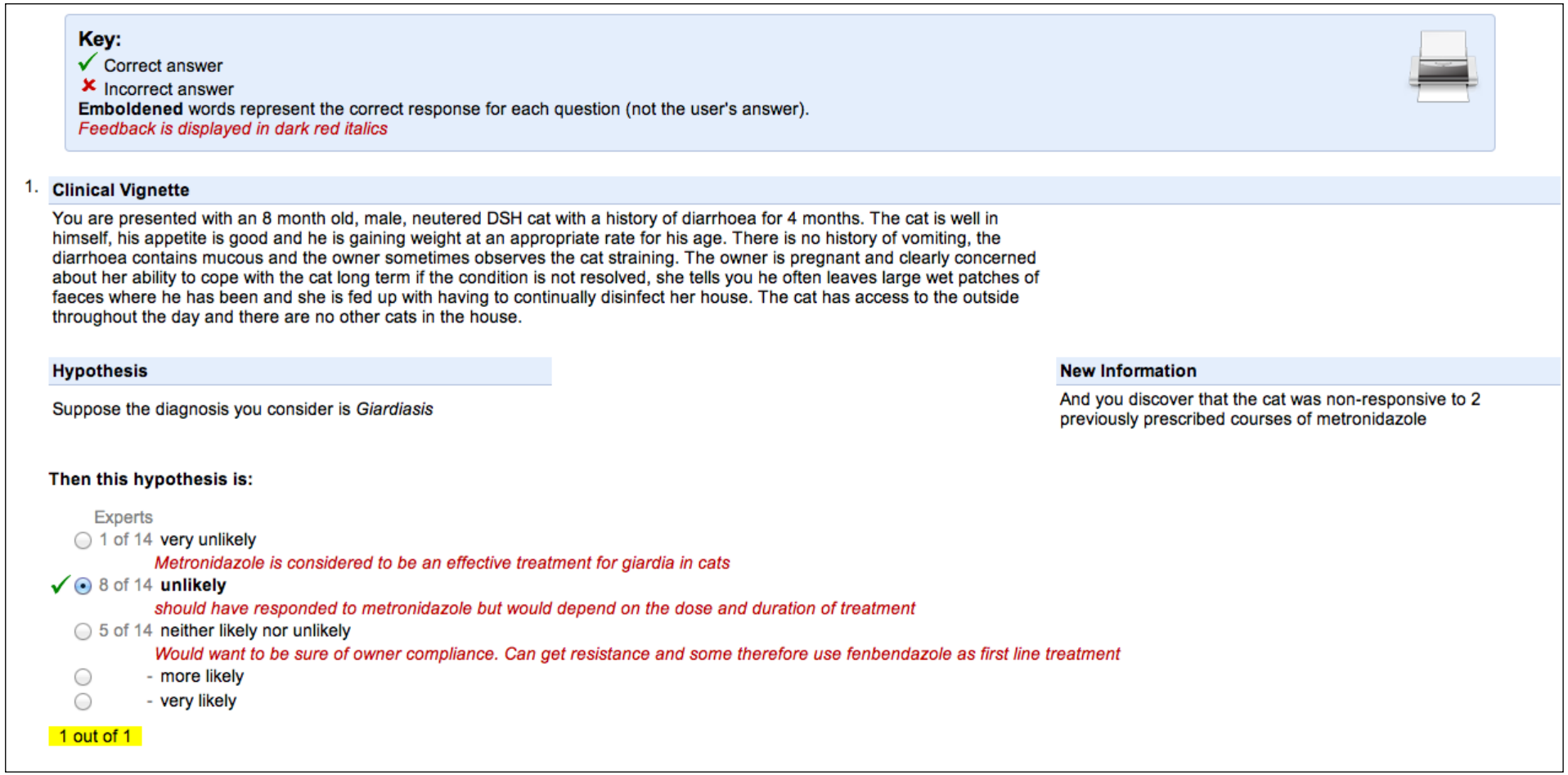

Figure 5.3: The feedback screen as seen by the students on completion of the formative SCT assessment. Quantitative feedback shows how many vets from the panel selected each response. Their qualitative comments are provided to enable students to understand their reasoning.

5.2.2.2: The focus groups

On completion of each of the first two SCT assessments students were invited to attend a focus group, the dates and attendance for each focus group are provided in table 5.5. The focus groups were held at the SVMS and all participating students were provided with a consent form explaining that their data would be anonymysed, treated confidentially and that they had the right to withdraw from the study at any time (appendix 12). Each group lasted around 30 minutes, was recorded using a digital voice recorder and the recordings were transcribed verbatim. The questions used as a framework for the focus group discussion are included in appendix 13.

Focus group	Date	No. of attendees
1	25.07.2012	3
2	26.07.2012	3
3	30.07.2012	1
4	06.08.2012	3
5	06.12.2012	6
6	13.12.2012	2
7	10.01.2013	10

Table 5.5: The dates and number of attendees for each of the focus groups

5.2.2.3: The SCT survey

The focus group data were used to inform the design of a questionnaire administered to all participating students in April 2013. Participants were sent an email with a link to the online SCT questionnaire (appendix 14). The responses were collected using SurveyMonkey™

(http://www.surveymonkey.com). A pilot study with three final year students resulted in minor modifications to the final version. Participants were required to select responses on Likert-type scales and provide free text comments. The questions explored the students' perception of the format and feedback they received, their approach to answering SCT questions, the resources they used and the SCT in relation to clinical reasoning. The students were asked to rate the SCT in comparison to other assessment formats they had been exposed to in either year 4 or 5 of the course, a summary of these formats is provided in table 5.6. The full version of the questionnaire is included in appendix 15.

Assessment format	**Description**
MCQ	Delivered in all 5 years of the course, completed online and consists of A and R-type questions
DOPS	Work-place based assessment of clinical skills, completed during university rotations in year 5
Clinical Reasoning exam	Delivered in year 4, a case based, short answer paper where students are required to write free text responses

Table 5.6: Assessment formats used for comparison to the SCT in the survey.

5.2.2.4: Data Analysis

The qualitative data were analysed using thematic analysis (Braun and Clarke, 2006) with the aid of the computer assisted qualitative data analysis software, QSR International NVivo version 10, (2012). Initial codes were identified using an inductive approach and subsequently organised into broader themes that describe the salient features of the

data. Collaborative coding of one transcript enabled the initial codes to be refined in an iterative process until both researchers agreed the coding structure. This coding was then used to analyse the remainder of the transcripts by the primary researcher.

All quantitative data from the survey was analysed in IBM SPSS version 19. In order to carry out statistical analysis Likert-type responses were converted to a numerical scale and appropriate non-parametric statistical tests used (Jamieson, 2004). Friedman's ANOVA was used to compare ratings for different resources used by students and different exam formats. Mann Whitney U and Fisher's exact tests were used to compare responses from students who had attended the focus groups and those who hadn't.

5.2.3: Results

Out of a cohort of 90 students, 50 students (56%) registered for the study. Of those 46 completed the first assessment, 44 completed the second assessment and 35 completed the third SCT assessment. 18 of the registered students (36%) participated in focus groups and 28 (56%) completed the survey.

5.2.3.1: The focus groups

A summary of the themes that emerged from the analysis is presented in figure 5.4. The themes generated corresponded to components of the assessment utility equation (Van Der Vleuten, 1996). However, 'feasibility' and 'cost effectiveness' were not identified as themes during analysis, this is not surprising given the data were generated from student focus groups

and did not involve university staff. Examples from each theme are illustrated with quotations referred to as Q1, Q2 etc. Focus groups are identified by when they occurred.

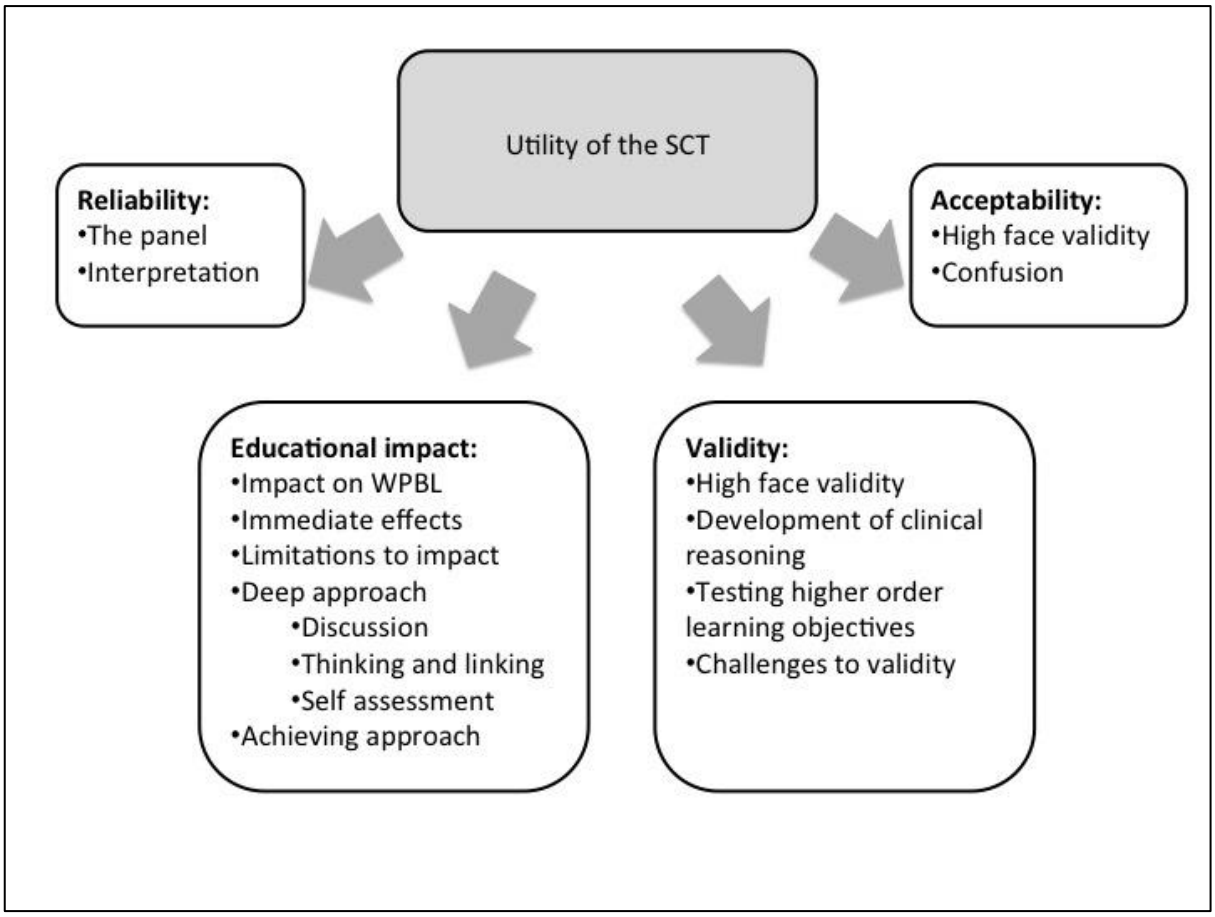

Figure 5.4: A summary of the themes identified in the thematic analysis of the focus group data.

Educational Impact: A theme that clearly emerged from the data was the educational impact of the SCT including its influence on the learning behaviour of students. There was evidence of a deep approach to learning in response to the SCT assessments; in Q1 the student describes thinking in more depth about a case or condition and linking the questions to previous experience:

Q1: *"Often with the MCQs I would try and picture like a lecture slide I've seen or something I've written in my notes. Whereas with this one* (SCT) *I try and think back to like if I was to see this case, what would I do? I try and think through it step-by-step, whereas I just try and search for that one slide in my head when it's an MCQ."* [FG4]

Q2 illustrates how the feedback provided by the expert panel encouraged a discussion around a case:

Q2: *"Well I find that normally it just tells you the answer and you just accept that yes I got it wrong. Whilst these ones* (SCT) *kind of provoked more discussion because there were different opinions."* [FG2]

Some students, however, demonstrated a more achieving approach to the formative SCT at the expense of deeper learning, demonstrated in Q3:

Q3: *"I immediately scrolled down to the bottom to see what my score was and then I was quite happy with the mark that I got and I just quickly just flicked through to see a couple of the answers that I got wrong"* [FG3]

The data indicated that the impact of the SCT extended to workplace-based learning, which was considered essential to success in the SCT format. In Q4 the student describes how the SCT encouraged a more enquiry-based approach:

Q4: *"I find myself asking like why would you do this instead of that a bit more. So why did you choose to do an x-ray instead of an ultrasound in*

this case? Because then you know that's kind of the reasoning you need to have when you do this exam." [FG6]

Many students commented on the immediate impact of the SCT. They found the way in which the SCT is marked reassuring and resulted in less pressure to select the one correct answer:

Q5: *"From a student perspective that makes it a bit less daunting because it's not one answer in five that you've got to get or one answer in four that you've got to get. There's a couple of options there."* [FG6]

Although others were less positive about the format and reported the SCT to be confusing illustrated in Q6 and Q7:

Q6: *"See I don't like it. I find it too vague. More likely, less likely, a little bit more likely. I don't like the fact there isn't a right answer. It really upsets me [laughter]. Because I'm like even if I get the right answer, I still won't get a hundred per cent of the marks. That annoys me."* [FG4]

Q7: *"My first thoughts when I actually did it was that I didn't really think I would have done very well because I was quite confused about the whole thing and I don't know, it's a lot of information to process through and then make it into one sort of click on a button answer."* [FG2]

Acceptability: The majority of participants found the SCT an acceptable format because of its high face validity. The students considered the SCT to be a better assessment of their abilities as a vet and more relevant to

decision making in clinical practice, particularly in comparison to the MCQs they have experienced so far in the course (Q8):

Q8: *"The MCQs, the normal online ones, don't seem to assess how you'd act as a vet, whereas these* (SCT) *seemed to be a lot more comparable to sort of everyday clinical decision-making."* [FG5]

Some students expressed concerns over the different approaches to diagnosis and case management they have observed in practice. This is not reflected in a single best answer MCQ format. However, the SCT provides some reassurance that the differing opinions of a panel of clinicians are considered, illustrated in Q9:

Q9: *"But I think it's good how it shows people do have different opinions and there isn't often like a right thing. There might be a varying range of things to do and they can all be right."* [FG1]

Students reported aspects of the SCT that they found less acceptable. Despite the information given to them by the university, the students had little awareness of what the SCT entailed. Q10 demonstrates that any prior knowledge of the SCT is often from other students:

Q10: *"I would say that I had no idea. I'd heard a lot of rumour from years previously. I seem to remember them just talking about it as being there's lots of right answers basically, and until now I didn't know*

anything about it really. I knew that it happened, but I didn't know what it involved." [FG3]

Some students therefore felt it would have been useful to introduce the SCT earlier in the course so that they could get used to the novel format but also to help develop their clinical reasoning skills (Q11):

Q11: *"I think it would be quite a useful teaching resource as well maybe to have some of these in with like either with the year four or the year five material. To really make you think about how you're going to treat things which you don't really spend year four doing too much. You learn how to treat them, but you don't really think about applying it and how cases might be different."* [FG1]

As illustrated in Q7, it takes time to become familiar with the SCT format and there is evidence to suggest that both the students and the panel were confused as to how to answer some of the questions:

Q12: *"I didn't know if it was the layout, but I noticed that some of the answers, like they* (the panel) *based their answer based on say what the treatment or the management was going to be, not on the new information? So I was a bit confused as to whether you're supposed to take the information into account or just go with what they've suggested."* [FG5]

Some of the confusion appears to be due to the wording of the options and the on-screen layout. However, the order of the questions in the

paper also contributed to confusion perhaps because this does not represent the clinical reasoning process in practice:

Q13: *"And it's difficult because it seems to ask you to sort of disregard the information in the previous question and then have a new one, which is hard because it's not how case progression works in any way in your mind."* [FG2]

Whilst these challenges to the acceptability of the SCT are accepted in the context of this study, where the results do not contribute to their degree mark, in Q14 the student expresses concern over the weighting of the SCT in the summative assessment at the end of final year:

Q14: *"I'm fine with it being a way of assessing because it's twenty per cent. So I'm happy with that. That's fine but [laughter] yeah. If it was worth any more then I would probably have something to say about it."* [FG7]

Validity: Discussion often included the process of clinical decision-making and how this related to the SCT (Q8). A theme of validity therefore emerged, as the SCT is an assessment of clinical reasoning. In Q4 and Q15 the students describe how they use their clinical experience to make decisions about a case when completing the SCT:

Q15: *"Because it's not what you were taught, it's what you have seen in practice, what you think works, what you think is going to allow you to*

move on to your next diagnosis. It's more realistic basically than 'this is what we got taught so it must be this answer'." [FG7]

Some students felt that the SCT tested their decision-making but not necessarily the reasoning behind their decisions:

Q16: *"Decision-making yes, but not reasoning, because you're not… You don't have to justify what you're saying."* [FG7]

This is also evident in Q17, where the student appears to adopt a type 1 approach to reasoning:

Q17: "*I finished the second one much quicker than I finished the first one because I realised having looked at the answers from the first one, just don't over-think it, that's just my opinion. Just go with what you think"* [FG7]

In contrast the students in Q18 and Q19 describe how during the SCT they work through the case information to make a decision. For these students the SCT requires them to apply their knowledge and justify their reasoning before they make a decision, more representative of type 2 reasoning:

Q18: "*I would much rather sit down and actually think things through and try and justify an answer rather than have to remember something. So memorising for me is I find that quite difficult personally, but if I can work*

it through and apply principles and apply knowledge, I personally find that more straightforward." [FG7]

Q19: *"I've thought about it more and I had to just definitely justify it because you have to weigh up all the different options."* [FG7]

Many of the students talked about higher order learning objectives being tested during the SCT. Processes such as analysis of information and application of knowledge are important in clinical reasoning and are illustrated in Q20:

Q20: *"It feels like you apply your knowledge more with a script concordance test rather than just like a normal MCQ for me."* [FG6]

However, several participants challenged the construct validity of the SCT. For example, when the hypothesis to consider had not been generated as a result of their own thought process, making a decision was more difficult:

Q21: *"I sometimes didn't really know where to go with the information. If I thought there was an infected joint, I think there was talk about using ultrasonography and I don't think I'd have had that up there at all. So then I didn't really know whether it was more likely or whether it was more unlikely or less unlikely."* [FG4]

Some students perceived there to be insufficient information in some questions and described how in practice they would not have made a decision at that stage:

Q22: "*Yeah and if you didn't want to make a decision at that point, there are other things you can do and stuff."* [FG2]

Reliability: A significant concern for many participants was the reference panel. Although they have confidence in the number of vets used on the panel, several students raised concerns over the experts' interpretation of the question (Q12) and the spread of panel responses:

Q23: *"I was going to say I did like the fact that you do get graded. So 0.8 or 0.2 per cent of a mark which is good. Instead of saying, 'Okay. It's just this answer and nothing else.' But you could have been, you know, in the same mind-set of a clinician who is practicing, who is quite good at their job, but you still are borderline."* [FG7]

Q24 illustrates how some students perceived the need to weigh up the different options depending on whether they answered the question according to what they 'should do' based on what they have been taught at vet school or according to what they 'would do' based on their experience and the limitations of first opinion practice.

Q24: *"I sort of thought, 'Well if you were doing it by the book, then it's going to be pretty near the top, but in reality, I don't think you would go*

running straight to the Ministry about it. Then it's like, 'But what would actual vets do?' So I'd put it near the top because that's what you should do but not what you would do." [FG1]

In the final quotation the student describes how the likelihood of certain options being selected influenced their responses:

Q25: *"I think I tended to stay in the middle sort of three categories. Like the neither and then a little bit more or less, but I think that was just me being safe and not wanting to commit. There were quite a few where if you just put the middle one, you'd get like half a mark because if it was like a little bit ambiguous."* [FG2]

5.2.3.2: The survey

Student perception of the SCT format

Twenty-eight students responded to the survey, 12 of those respondents had also participated in one of the focus groups. Of those students who completed in the questionnaire, 64% of students felt the SCT format was difficult to understand, there was no statistically significant difference in responses from students who attended the focus groups and those who hadn't attended (U=98.5, p=0.909).

Students found some sources of information more useful when answering the SCT (table 5.7); clinical experience was rated most useful (χ^2=48.7, p=0.000). There was no statistically significant difference in responses from students who attended the study focus groups and those who hadn't attended (U=68.0, p=0.205).

Source of Information	VU	SU	OLU	NU
Clinical experience	21	7	0	0
Lecture notes	5	16	6	1
Internet search	2	11	14	1
Textbooks	0	19	8	1

Table 5.7: Student responses to the question "How useful do you find the following sources of information when answering the SCT?"
VU = very useful; SU = somewhat useful; OLU = of little use; NU = not at all useful

75% of participating students agreed that the SCT format was a useful tool for the development of clinical reasoning skills. 67.9% agreed that the SCT was a good test of their clinical reasoning skills, this difference may be explained by students who attended a focus group rating the SCT as a poorer test of clinical reasoning than those who had not attended (U=49.0, p=0.029). 71.4% agreed that the feedback screen helped to develop clinical reasoning skills. Figure 5.5 illustrates how the students perceived the SCT for the development and assessment of clinical reasoning skills.

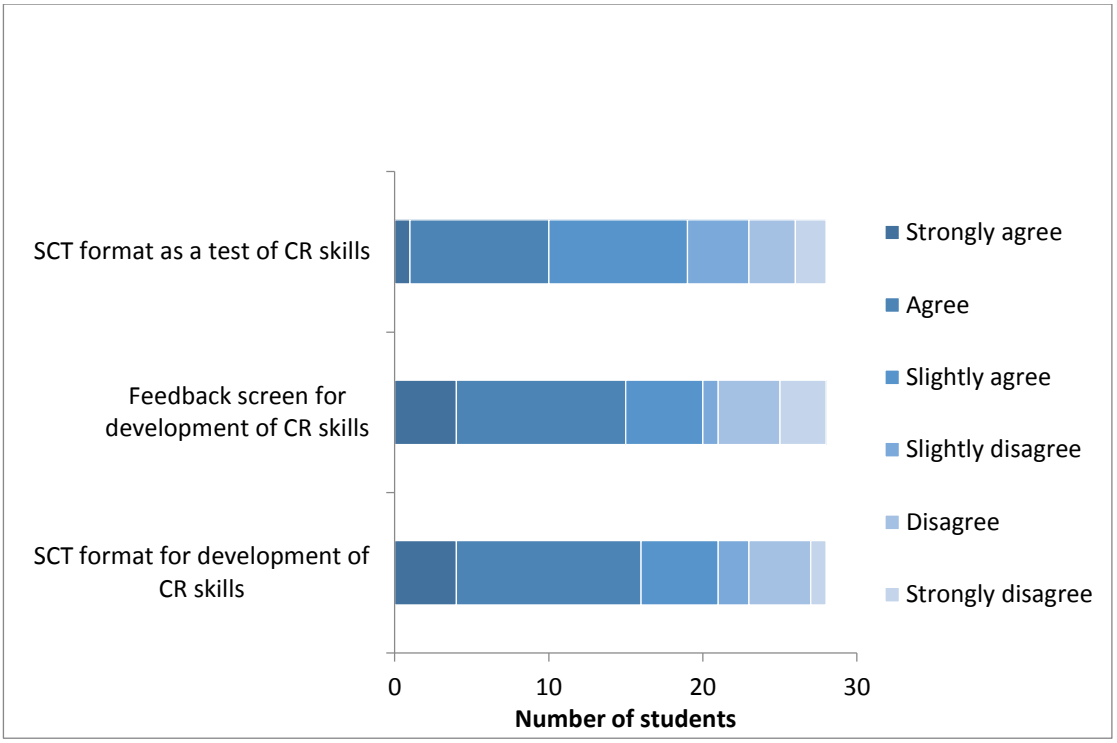

Figure 5.5. Student perception of the SCT for developing and testing clinical reasoning (CR) skills

The impact of the SCT on learning behaviour

The effects of different assessment formats (table 5.6) on students' learning behaviour are reported in this section and summarised in figure 5.6. Students reported that they used their knowledge in different ways when completing different assessment formats (χ^2=49.1, p=0.000). MCQs require mainly recall of information, whereas the SCT, DOPS and clinical reasoning exam formats require students to apply their knowledge. There was no statistically significant difference in responses from students who attended the study focus groups compared to those who hadn't attended (U=116.5, p=0.347).

Students perceive the clinical reasoning exam as the 'most fair' assessment of their clinical ability (χ^2=23.6, p=0.000). When rating the SCT format, those students who had attended a focus group thought it was a less fair assessment than those who had not participated in a focus group (U=36.0, p=0.004).

The SCT format was most likely to promote discussion of cases with vets or their peers; however, the difference in responses to the 4 assessment formats was not statistically significant (χ^2=6.84, p=0.077). The students who participated in the focus groups felt the SCT was more likely to promote discussion than those who hadn't attended a focus group (U=147.0, p=0.017).

Students perceived the DOPS assessment to have the greatest influence on their approach to clinical rotations or CEMS (χ^2=42.9, p=0.000). There was no statistically significant difference in responses from students who attended the study focus groups and those who hadn't (U=92.5, p=0.873).

There was a difference in how students felt each assessment format would encourage them to read around a case or topic (χ^2=18.6, p=0.000), with DOPS being the most likely to encourage additional reading. There was no statistically significant difference in responses from students who attended the study focus groups and those who hadn't (U=113.5, p=0.423).

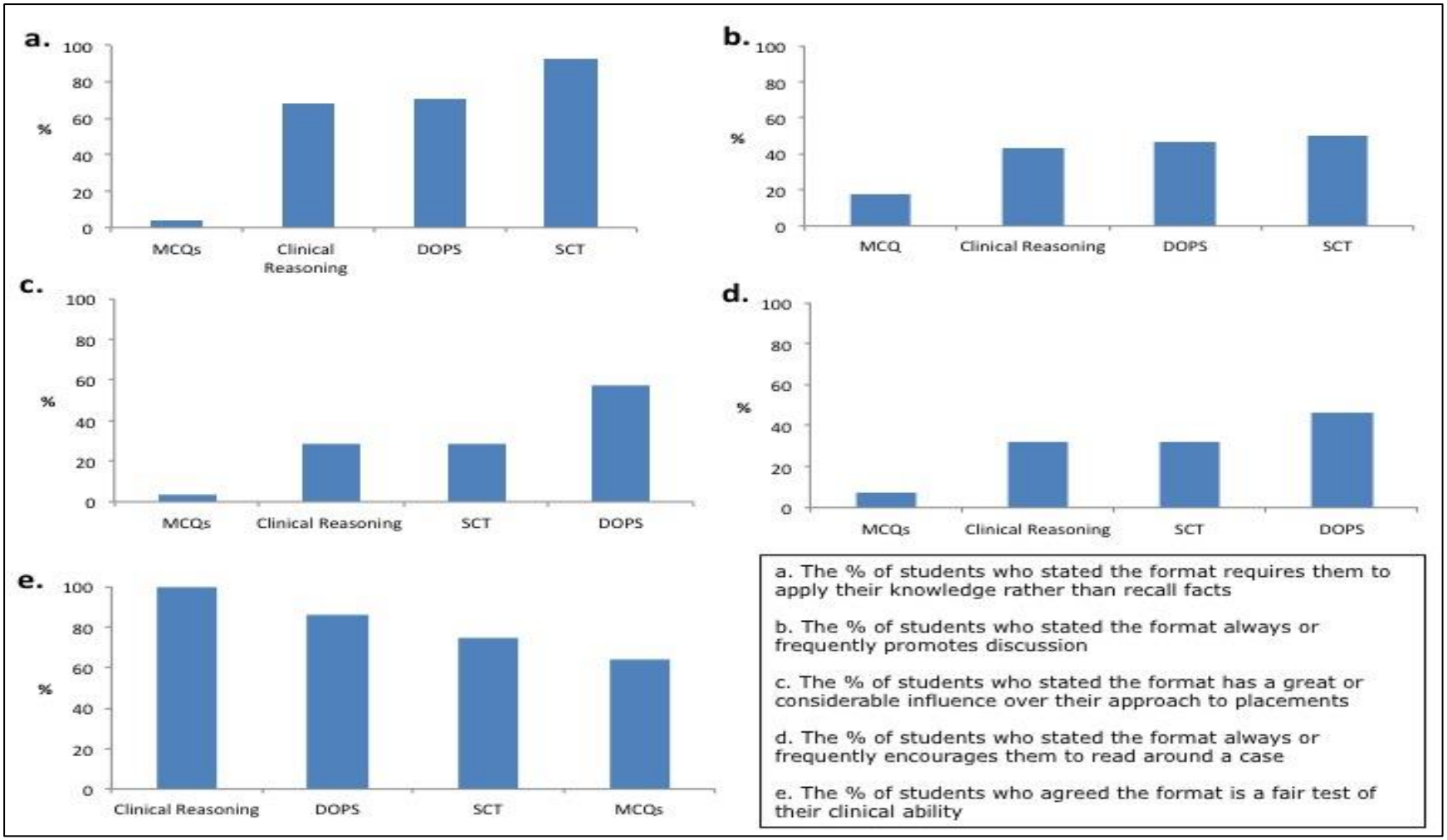

Figure 5.6: The effects of the SCT, DOPS, MCQ and the clinical reasoning examination on students' learning behaviour

5.2.4: Overview and implications of study 4

In study 2 (chapter 4) the SVMS graduates rated the SCT lower than MCQs or DOPS as preparation for clinical practice and perceived it to be less relevant to the role of a veterinary surgeon. In contrast the 5th year students who participated in this study perceived the SCT to be a good assessment of clinical reasoning and helpful to the development of their reasoning skills. Furthermore they reported that they were encouraged to reflect and draw upon their clinical experience when responding to SCT questions. The addition of the feedback screen with comments provided by the expert panel added to the learning experiences of the students by promoting discussion and to some extent further reading. For some students the impact extends to WPBL where the SCT encourages a deeper approach to cases and discussion with both their peers and supervising clinicians. This study therefore demonstrates how the SCT can potentially enhance CA within a curriculum and also adds to the sparse published evidence on students' perception of SCT and its impact on their approaches to learning (Hornos et al., 2013).

However, the students' perceptions of the SCT were not all positive. They raised concerns over the variation in panel responses and the experts' interpretation of the SCT questions. Both the question structure and the concept of reasoning around limited case information were found to be confusing for some students and not aligned to the clinical reasoning process in practice. These findings support the concerns raised by Askew et al. (2012) and Lineberry et al. (2013). Consideration of these issues in the context of a high stakes, summative examination may provide some

explanation as to why the graduates had reservations over the SCT and rated it lower than other assessment formats in study 2.

The participants of this study were able to express their opinion of the format over the course of the year in response to formative SCT questions. Although the SCT formed part of their summative finals examination, it is likely that the additional formative experience and the timing of data collection resulted in a more positive opinion of the SCT compared to that of the graduates. The students reported the SCT enhanced the development of clinical reasoning skills and encouraged deep learning strategies; therefore this format has the potential to be part of an assessment strategy aligned to the curriculum and ILOs of the SVMS course. However, comparison of these results and the opinion of the graduates in study 2 suggest that effective implementation of this novel format is essential to its success.

In the current context of the SVMS final year, without the additional formative SCT experience that was provided for the purpose of this study, the SCT is not well aligned. The perceived benefits of the SCT as an authentic assessment of clinical reasoning are likely to be outweighed by the effects of a new format introduced as part of a high stakes examination with little formative practice. Simple interventions have the potential to ensure alignment of the SCT within the curriculum: students, question authors and panel members need to be better educated to appreciate the purpose of the format and understand how each item should be interpreted; on-going formative experience should be provided

with meaningful feedback and students must be allowed time to reflect on and discuss the cases in greater detail.

Although these results support the use of the SCT to develop clinical reasoning skills in veterinary undergraduates, some students described a response to the questions analogous to type one reasoning or pattern recognition. Tomlin et al. (2008a, 2008b) reported similar results following an EMQ clinical reasoning assessment. In those studies, staff and students were concerned that pattern recognition was not appropriate for undergraduate students with limited clinical experience and questioned the use of an assessment format that fostered this approach. Evidence from medical education suggests that providing students with instruction on combined reasoning allows an appreciation of both analytic and non-analytic strategies and also improves diagnostic accuracy (Eva et al., 2007). Similar interventions in veterinary education could be beneficial when used with formative assessments to enhance the development of appropriate clinical reasoning strategies.

The majority of students agreed that the SCT helped to develop their clinical reasoning skills, however participation in the focus group discussion appears to have influenced some students' perceptions. Focus group participants perceived the assessment to be less fair and a poorer assessment of clinical reasoning, however, they felt it encouraged case discussion more than non-participants. Although it is not clear if focus group participation resulted in these differences, or whether they can be attributed to a self-selecting group of students, facilitated small group discussions might be of use in educating students about their

assessments. Increased understanding of the purpose of the assessments they are exposed to might help them to adapt their approach and therefore improve performance.

As with the previous study in this chapter, the results were generated from a sample of volunteers from one cohort of students at the SVMS. It is therefore important to acknowledge that the participants may not be representative of all veterinary students and may demonstrate a different approach to their learning and clinical development. Their opinions and perceptions are almost certainly in part due to the formative purpose and implementation of the assessment in this context as well as the SCT format *per se*. However, despite these limitations the results of this study add to existing evidence for the use of the SCT in the assessment and development of clinical reasoning skills.

In conclusion, prior to this study the positive influence of the SCT on learning behaviour was limited due to the context of the high stakes end of year examination. Addition of further formative practice and opportunity for discussion of the assessment has enhanced the alignment of the SCT within the curriculum. Future developments should focus on the authenticity of scenarios during item development and education of the students and the expert panel on the SCT format is essential if optimal alignment is to be achieved. With this in mind this novel format has the potential to encourage a deep approach to clinical development amongst students consistent with CA theory.

5.3: Discussion of studies in chapter 5

This chapter has explored the educational impact of DOPS, MCQs and the SCT on final year veterinary students. DOPS and to some extent the SCT were perceived as authentic assessments; students reported deep approaches to learning in response to these formats consistent with CA theory. Students placed value in the DOPS as an assessment of their clinical skills within a real practice environment and the SCT as an assessment of clinical reasoning. Both formats generated feedback that enabled the students to develop as clinicians and were in alignment with the ILOs of the course. In contrast the MCQ is perceived as a more superficial assessment of veterinary knowledge requiring recall of information with little application or relevance to the role of a veterinary practitioner. In this context the MCQ has a negative impact on CA because the perceived purpose drives surface learning strategies, even amongst these deeply motivated students, and this approach is neither aligned with the curriculum philosophy nor the ILOs of the course. However, the results of studies 3 and 4 suggest that to ensure CA within a curriculum, the context and implementation of any assessment is as important, if not more so, than the format itself.

The research within this chapter has highlighted assessment related factors that influence learning behaviour and therefore potentially impact CA. Effective formative assessment is known to have a positive impact on learning (Nicol and Macfarlane-Dick, 2006, Ericsson, 2007, Carraccio et al., 2002, Fuentealba, 2011), it is therefore unsurprising that the students were found to value lower stakes assessment with time to reflect upon feedback and employ deep learning strategies which allow them to

improve their performance. Other factors found to influence learning behaviour included the consequence of assessments. High stakes assessment with a lack of feedback were often reported to have a negative educational impact, however, assessments with a purely formative purpose are insufficient to drive learning amongst these students. In addition to the curriculum and final year assessments, the students reported case responsibility and their career in veterinary practice to have an increasing influence on their learning as they approach graduation. Similar to the findings of Cilliers et al. (2010), for some students there appears to be a conflict between learning for their undergraduate assessments and learning to be a competent practitioner on day one. This conclusion is not consistent with CA and led to the development of the research on the transition from student to practitioner in chapter 6.

The students adapt their study approach based on their perception of the requirements for the approaching assessment tasks. There is variation in these adaptations according to the individual student; however it appears that for most these perceptions are based on personal experience and to some extent the experience of other students. Despite guidance provided in course documentation these students tailored their learning based on what they considered to be a successful strategy. This is perhaps a consequence of assessment in higher education that has traditionally been teacher driven with little discussion or input from students and often based on the teacher's personal experience of being assessed (Price et al., 2012, Rowntree, 1987). To some extent this culture still exists within veterinary education and the effects of this were sometimes observed

within the studies in this chapter. A lack of insight into the assessment strategy leaves students with no choice but to adapt their study approach based upon their own perceptions of what will ensure success in the examinations. Unfortunately the SCT provided an example of this lack of insight and understanding of an assessment. Some students were confused by the purpose and the format. For the graduates whose only experience was in the finals examination, it is not surprising that there was a lack of CA where the SCT failed to promote the development of clinical reasoning.

Rowntree (1987, p.57) provides a thought provoking analogy to this traditional form of assessment where the student is compared to a defendant on trial. They do not know the exact nature of their offence or the evidence against them; they are not told who laid the charges or who will make the judgement and have no counsel to advise them. This is clearly an extreme scenario, however it demonstrates a helpless situation where it is impossible to know how best to approach the case. The implication is if CA is to be achieved within a curriculum, clearly a more collaborative approach is required. The concept of assessment literacy is described by Price et al. (2012) where students understand the nature of the assessments they are exposed to and the standards expected of them as well as becoming proficient assessors themselves and understanding the relationship between assessment and their own learning. It is therefore recommended that assessment literacy is increased amongst students and staff at the SVMS to ensure all assessments are aligned with the rest of the curriculum and encourage optimal approaches to learning amongst students.

Despite the issues identified regarding implementation and the lack of insight into the assessments of some students, the SCT and DOPS had high face validity and consequential validity. Both studies provide evidence to support the use of DOPS and the SCT as a methods of assessment *for* learning (AFL) (Schuwirth and Van Der Vleuten, 2011a, Gibbs and Simpson, 2004). Whilst assessment *of* learning is required by higher education institutes to make judgements on students' performance this type of assessment often results in a negative educational impact. For example the MCQ is used widely within the SVMS assessment strategy as a summative, end of year assessment of veterinary knowledge where the consequence is progression to the next phase of the course or ultimately graduation. For many students this drives a surface approach to learning. The DOPS and SCT have been shown to enhance the learning environment promoting effective learning strategies; these formats should be further developed to fulfil the needs of *assessment of learning,* as required by the university, whilst supporting students in a positive learning environment, by providing *assessment for learning.*

AFL is emerging as an important theory in higher education and assessments that fit within this framework are essential to CA. However, whilst there remains a discrepancy between the student perceptions of what is required for exam success and the criteria for producing successful practitioners, assessment cannot completely support effective learning. This conflict between learning for exams and learning for practice initiated the study in the final chapter, exploring the opinions of students and employers on the transition from veterinary student to veterinary practitioner.

Chapter 6: What constitutes a successful transition to practice?

6.1: Introduction.

As students progress through a course, future employment in clinical practice has been shown to have an increasing impact on their learning behaviour (Cilliers et al., 2010). Similarly, in chapter 5, final year SVMS students described a conflict between learning for undergraduate assessments and learning for clinical practice. In chapter 4, the graduates did not consider all SVMS assessments to be good preparation for and relevant to the role of veterinary practitioner. These results therefore suggest that assessment has a negative impact on CA within the curriculum and that the transition to practice influences learning behaviour amongst final year students. Therefore study 5 described in this chapter aims to address research question 4:

4. What is the perception of final year students and employers of new graduates of the requirements for a successful transition to practice?

Figure 6.1 illustrates where study 5 fits within the overall research strategy in the thesis.

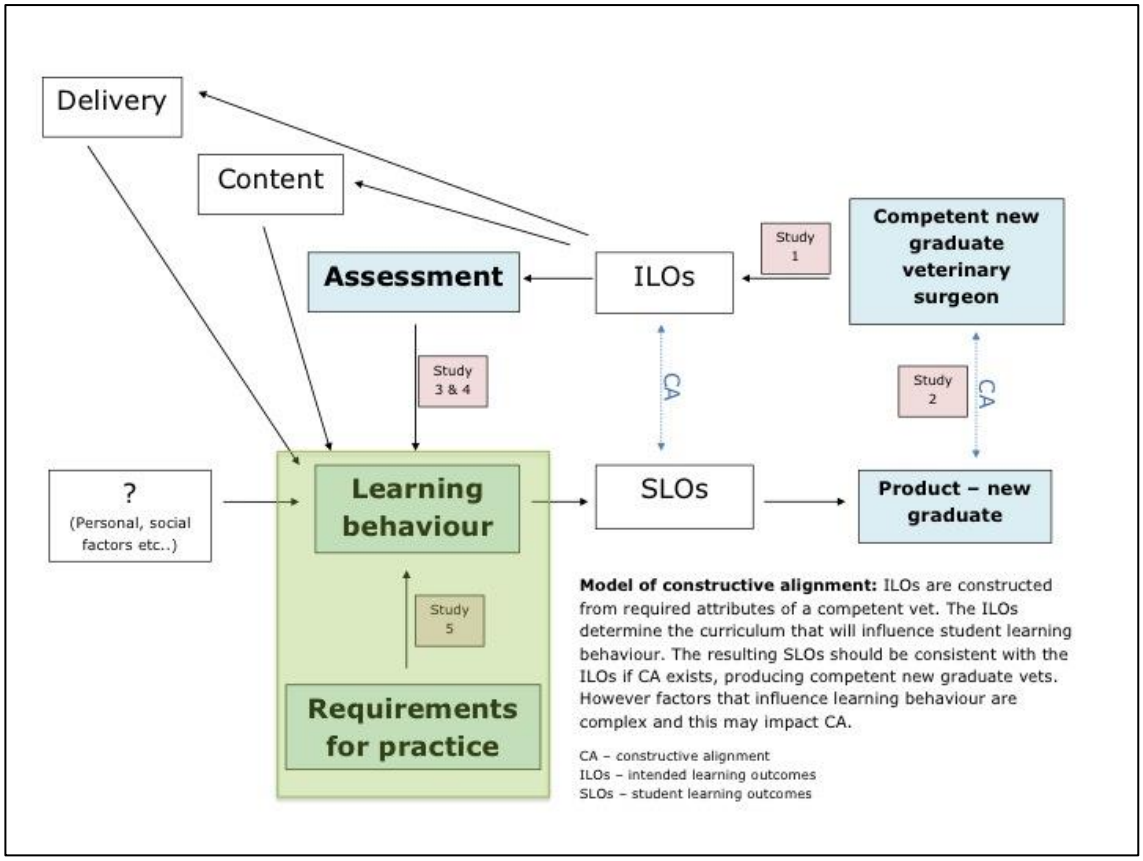

Figure 6.1: A model of constructive alignment highlighting study 5: the transition from student to practitioner.

Although previous studies have explored the perceptions of students and recent graduates on the transition to practice (Rhind et al., 2011), differences in curricula, learning environments and the student experience are likely to influence student opinion. It was therefore decided to collect data from Nottingham students to make the analysis relevant to the context of this thesis and employers to allow direct comparison of results.

The transition to practice has been described as a make or break period for many new graduates (Gilling and Parkinson, 2009) and appropriate support is seen as essential by both employers and graduates for success (Routly et al., 2002). Therefore, the nature of support offered during this

transition period was explored and employers' perceptions of veterinary education in the UK were also investigated.

6.2: Methods

6.2.1: The student survey

An email was sent to all 5th year students before their finals examination in April 2013 inviting them to participate in the survey. Students were provided with a link to the online questionnaire that comprised of three questions, illustrated in figure 6.2. A pilot study with three final year students was conducted but resulted in no changes to the final version. The responses were collected using SurveyMonkey™ (http://www.surveymonkey.com).

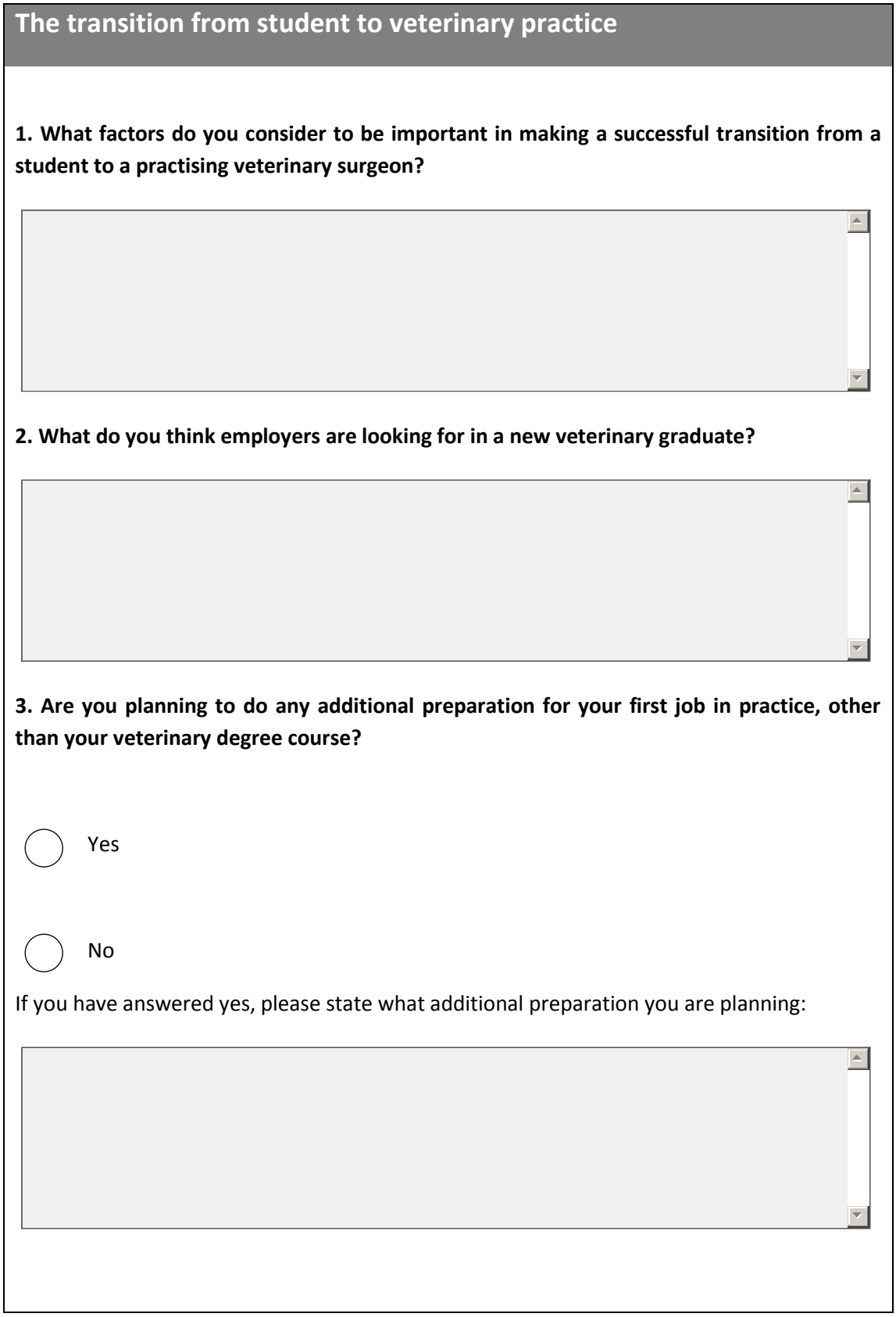

Figure 6.2: The student questionnaire on transition to veterinary practice.

6.2.2: The employer survey

The responses to the student survey were used to inform the content and design of the employer survey. Questions 1 and 2 from the student survey were used to enable a direct comparison of responses. In addition, the employers were asked questions relating to the value they placed on the UK veterinary degree; programmes of support offered to new graduates within their practice and the academic criteria and non-academic attributes they used in recruiting new graduate vets. Questions were also included on the type of practice in which they worked, a full copy of the questionnaire is provided in appendix 16.

An email was sent to practising veterinary surgeons known to the researchers requesting their participation (appendix 17) and a snowball sampling method (Brown and Edmunds, 2011) was used to increase the number of responses. In addition the survey was publicised through the Best Evidence Veterinary Medical Education (BEVME) online dialogue group (Whipp, 2011). Employers were able to complete the questionnaire online via SurveyMonkey™ (http://www.surveymonkey.com) or on a hard copy.

All survey participants (students and employers) were informed that data would remain anonymous and by completing the survey they were consenting to take part in the study.

6.2.3: Data Analysis

All free text responses were analysed with the aid of the computer assisted qualitative data analysis software, QSR International NVivo version 10, (2012). Initial codes were assigned to the student responses

to questions 1 and 2 (figure 6.2) immediately following data collection. The researcher repeated this process four months later and the 2 sets of coding were compared to refine the final coding structure (Saldaña, 2009). This finalised coding structure was subsequently used to analyse the dataset using magnitude coding to produce a frequency count of each initial code (Saldaña, 2009). The responses to the two equivalent questions from the employer survey were coded in the same way. Any novel initial codes identified from the employer responses were added to the coding structure and the student responses were crosschecked for these new codes.

A descriptive analysis of categorical data was performed in addition to statistical comparison of responses by practice type. Statistical analysis was performed in SPSS statistics version 21; a chi-square test was used to compare responses, Fisher's exact test was used where observed counts were less than 5.

In addition to the magnitude coding described above, any free text comments provided in response to the remaining questions in the employer survey were thematically analysed for each question (Braun and Clarke, 2006); initial codes were applied and subsequently grouped into themes for comparison with quantitative responses.

6.3: Results

6.3.1: Participants

28 students and 45 employers participated in the study. The types of practice represented in the employers' survey are illustrated in table 1.

		% participants
Species area covered	Small animal practice	40
	Farm animal practice	18
	Equine practice	4
	Mixed practice	38
Caseload	1st opinion only	76
	1st opinion and referral	24
	Referral only	0
Post graduate qualifications held by vets working within the practice	None	24
	Certificate level	67
	Diploma level and specialist status	47
Experience of employing new graduates	Currently employ	60
	Have previously employed	31
	Have never employed	9

Table 6.1: Employer demographics according to species area of expertise, caseload and postgraduate qualifications.

6.3.2: Comparison of students' and employers' perceptions of transition to practice and employability

21 initial codes were identified in the analysis of the student responses; an additional 14 codes were added following analysis of the employer data. The frequency of each code is reported as the number of participants mentioning the code, as a percentage of the total

participants, for both the student and employer groups. Figure 6.3 provides a comparison of student and employer perception of a successful transition from student to practising veterinary surgeon. A larger proportion of employers stated the importance of communication skills, confidence, a positive attitude, adequate support and interpersonal and teamwork skills. A larger proportion of the students stated the importance of clinical reasoning skills and knowledge and its application. Both groups placed similar value on knowing your limitations and seeking help; a small proportion of employers identified several generic attributes, for example 'caring', 'trustworthiness' and 'reflective ability' that were not mentioned by the students.

Figure 6.4 provides a comparison of the student perception of what employers are looking for when recruiting a new graduate veterinary surgeon and the employers' responses. The employers placed a large emphasis on personal attributes during recruitment, namely interpersonal and teamwork skills, communication skills and a positive attitude. Previous clinical experience was seen as important by over a third of employers; however students didn't think this was valued during recruitment. A larger proportion of students thought their practical skills and confidence in their own ability would be considered on employment, compared to the employer responses. Finally many students thought employers would be looking for a balance of a graduate who could work independently, yet know when to ask for help; less than 10% of employers mentioned either category in response to the question.

Finally the responses to these two questions regarding a successful transition and employability were combined, for the students and also for the employers, to create an overall impression of the attributes of a successful veterinary graduate. These responses were mapped to the ILOs defined in chapter 2 and the results are illustrated in figure 6.5. The frequency of each ILO is reported as the number of participants mentioning the ILO in response to both questions, as a percentage of the total participants in each group. Several of the criteria stated as essential to a successful transition or sought by employers during recruitment were not present within the SVMS ILOs or could not be expressed as a learning outcome. These criteria are shown in table 6.2.

Type of criteria or attribute	Not considered a learning outcome	Not included within the SVMS ILOs
Veterinary related criteria	*Previous clinical experience* *References* *Knowledge is less important*	*Understanding of local veterinary industry and issues* *Having a career plan* *Competence**
Generic personal criteria		*Trustworthy* *Common sense* *Positive attitude* *Independence*
Employment related criteria	*Support provided* *The first job*	*Realistic expectations of veterinary practice*
Other demographic criteria	*The university from which they graduated* *Graduate being local to the practice* *Gender* *Hobbies or other interests*	

Table 6.2: criteria considered important to securing a first job and a successful transition to practice that aren't specifically mentioned within the SVMS ILOs.

*Competence is not mentioned specifically although the components of clinical competence are described within the ILOs. It was used very broadly by employers and therefore difficult to map to a specific learning outcome.

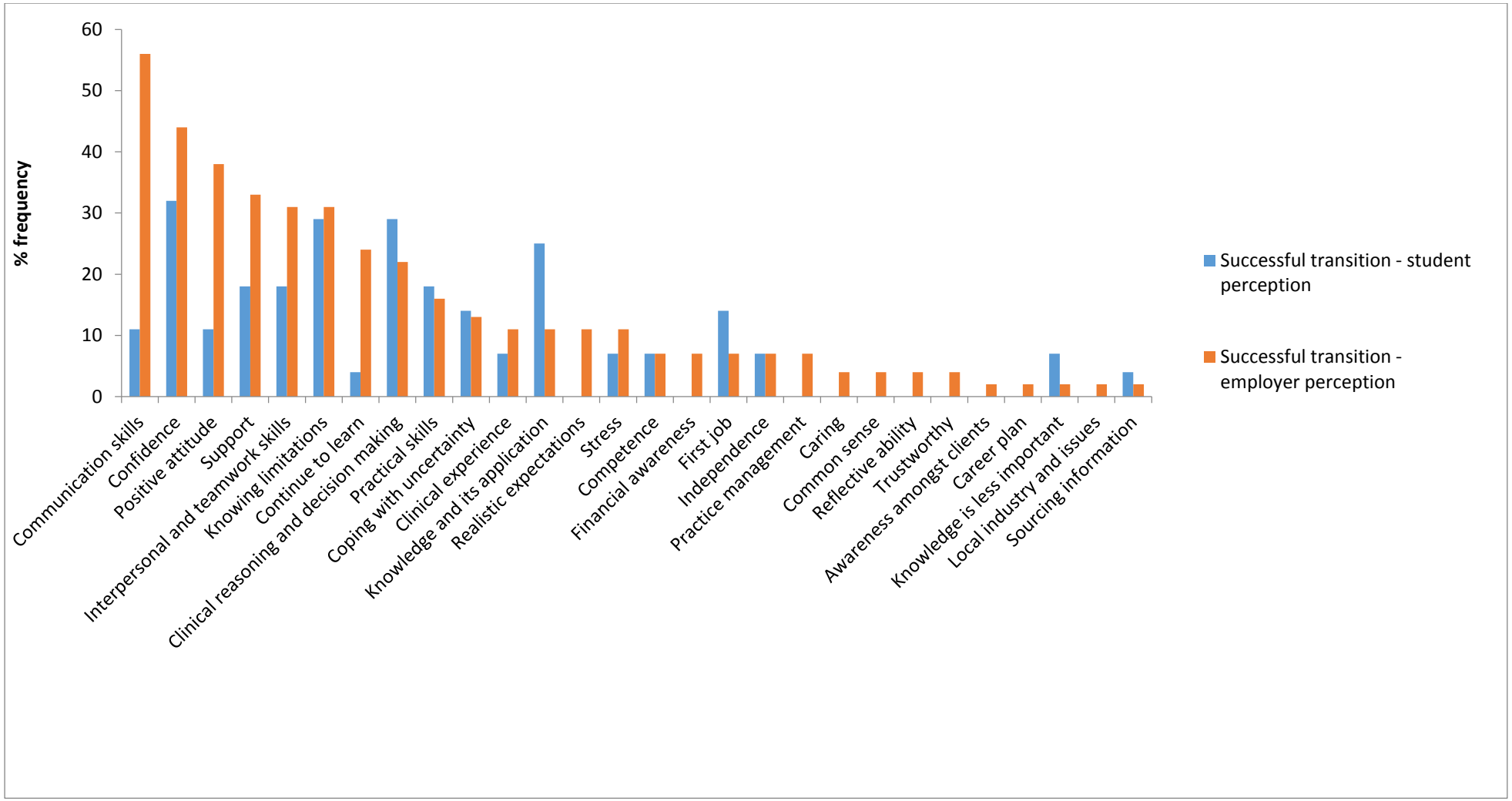

Figure 6.3: Comparison of the students' and employers' perception of what is important for a successful transition from student to practitioner.

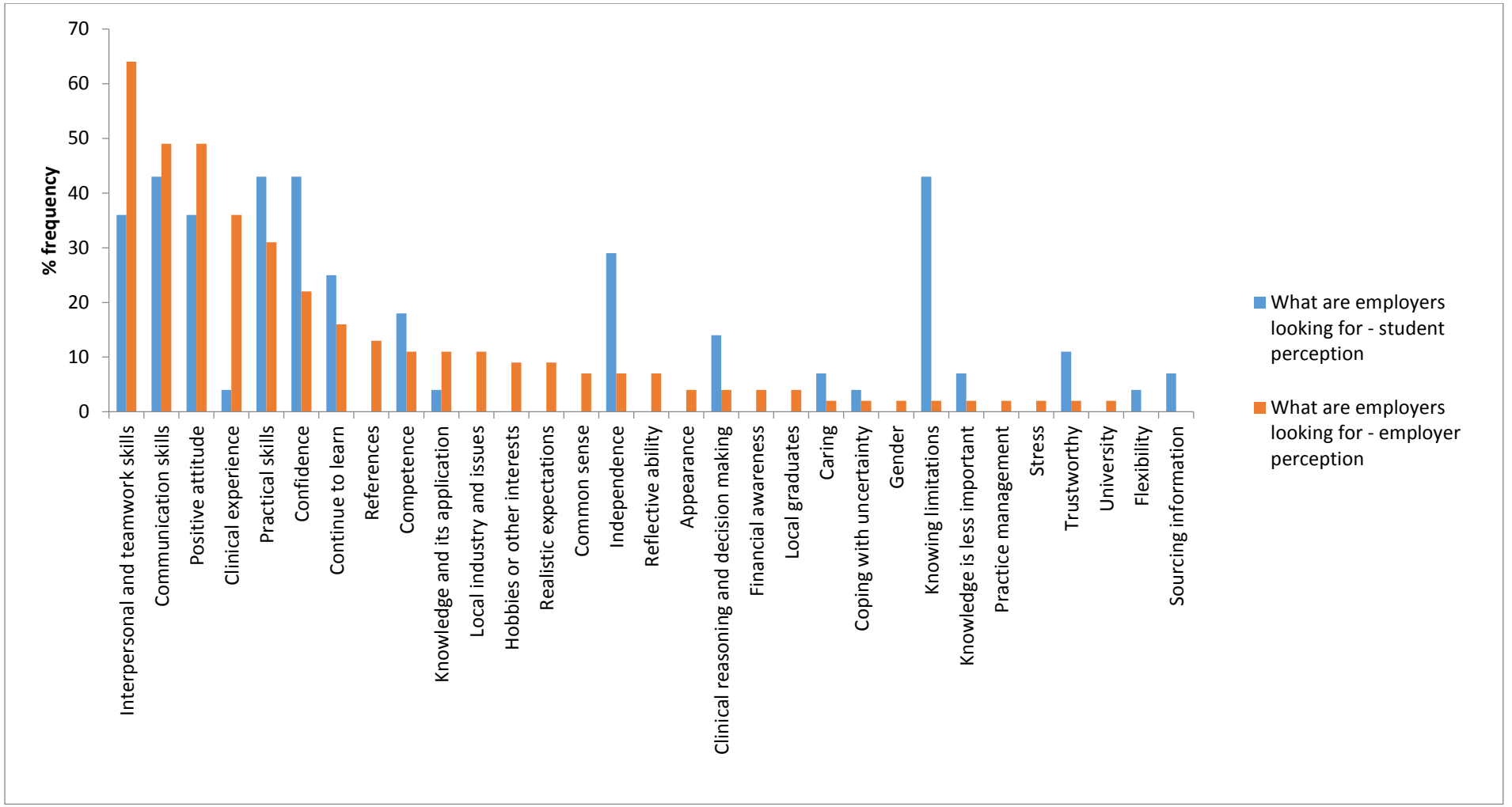

Figure 6.4: Comparison of the students' perception of what employers are looking for when recruiting a new graduate veterinary surgeon and the employers' responses.

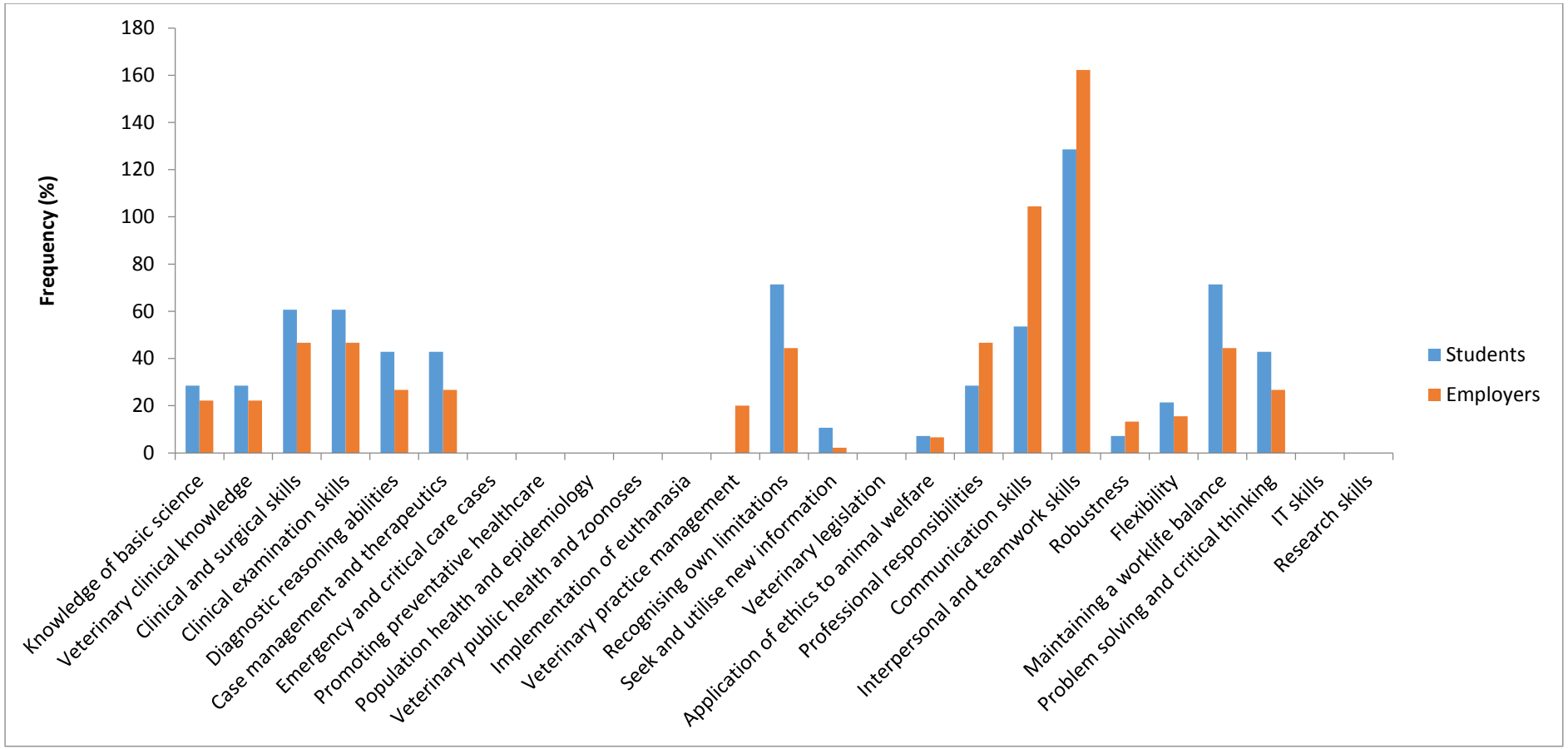

Figure 6.5: The criteria considered important to secure employment and to ensure a successful transition to practice: a comparison of the employer and student responses mapped onto the 25 SVMS ILOs. Frequency is calculated as the number of participants who mentioned the ILO in response to both questions as a percentage of the total number of participants for each group.

6.3.3: Preparation for the first job in practice

15 students (54%) said they were planning to do additional preparation for their first job in practice, other than their veterinary degree course. 12 students (43%) said they were not planning any additional work and 1 student did not answer the question.

Of those who were planning additional preparation, many stated they planned to do additional CEMS or unpaid veterinary work to gain further practical clinical experience. Other activities that students planned as additional preparation included:

- Additional reading
- Attending CPD events
- Interview workshops
- Time off/taking a break

6.3.4: The employers' perception of a UK veterinary degree

27 employers (60%) thought that the UK veterinary degree was adequate preparation for clinical practice, 18 (40%) of respondents did not consider it to be adequate preparation. There was no significant association between the perceptions of the UK veterinary degree and the type of practice employers were working in. Analysis of the qualitative comments identified perceived strengths and deficiencies of the degree and these are summarised in figure 6.6.

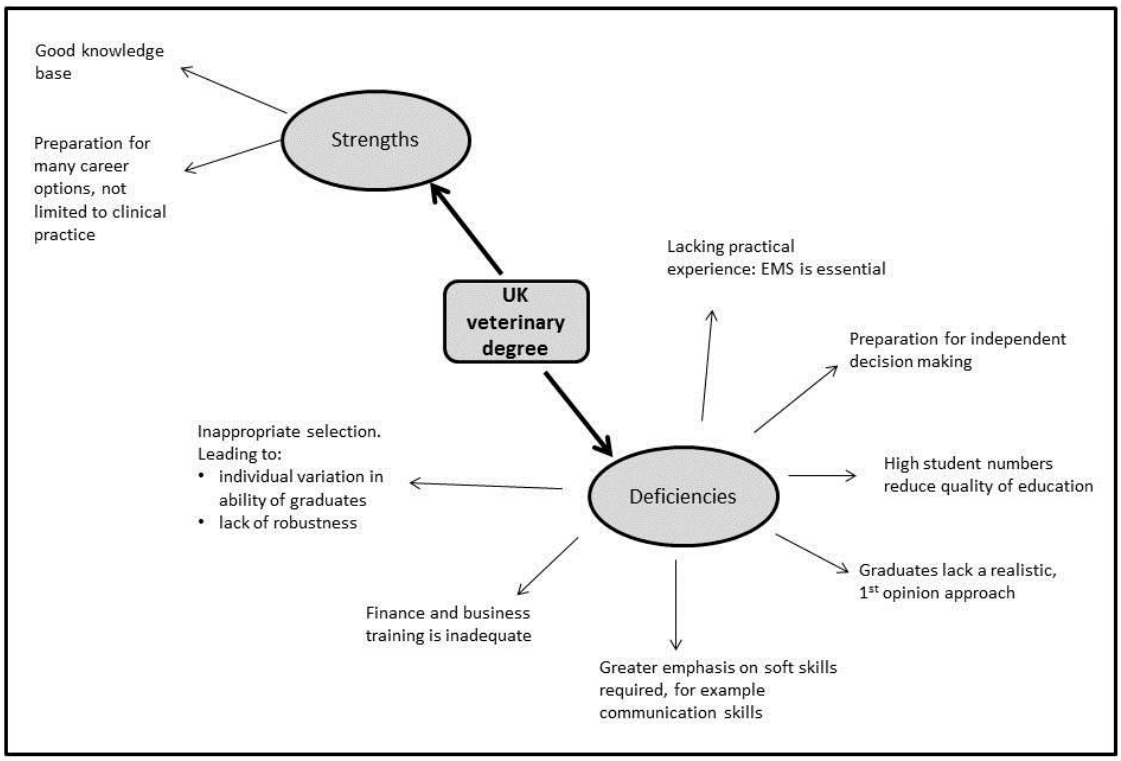

Figure 6.6: Employers' perception of the UK veterinary degree: strengths and deficiencies

6.3.5: Support provided to new veterinary graduates

36 (80%) of employers said that their practice had a programme of support in place for new graduate veterinary surgeons. Analysis of the qualitative responses identified the types of support offered, summarised in table 6.3.

Direct support or supervision within the role	Additional support mechanisms	Specific topics
Reduced out of hours cover or support during out of hours	Provision of a mentor	Support with communication skills
Support during the day from a VN/VS working at the practice	Regular meetings to discuss cases and any issues	Support with business skills
Support during surgery	Peer support network	
Longer consultation times	Externally provided/ corporate CPD	
Routine caseload only		

Table 6.3: Summary of the support offered by employers to new graduates.

6.3.6: Academic criteria and recruitment

The majority of employers who responded to the survey did not consider academic criteria to be important when recruiting new graduates, these responses are summarised in figure 6.7.

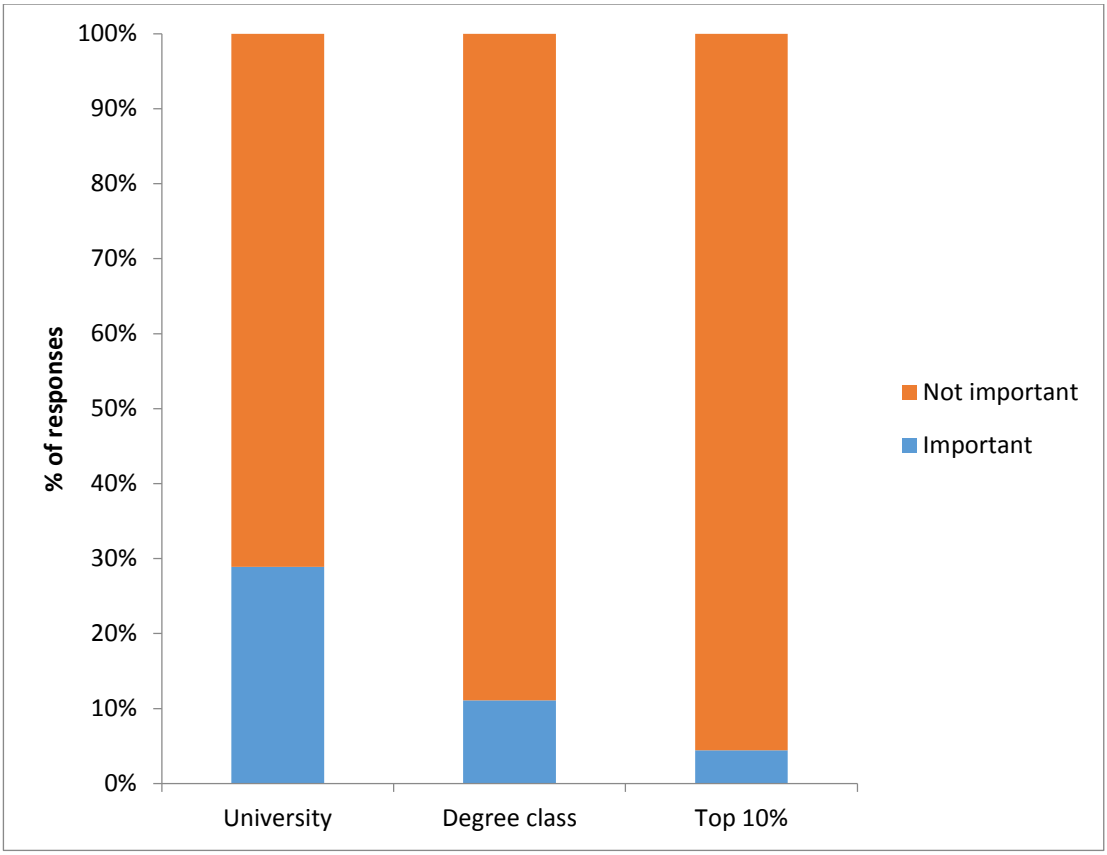

Figure 6.7: Percentage of employers who consider the university attended, the degree classification awarded and the graduate being within the top 10% of their year to be important when recruiting new graduates.

The university attended had the most influence on recruitment; analysis of the free text responses identified some employers who had a preference for different UK universities. Some employers expressed concern over employing foreign graduates as demonstrated by the following quote:

"Some foreign graduates are seriously disadvantaged often due to the lack of EMS which puts their UK counterparts at an advantage, and that includes the awareness of the veterinary world in the UK together with speaking the English language."

There was a strong feeling amongst employers that there is little correlation between academic achievement and performance in clinical

practice; a few went so far as to suggest that academic excellence could be a disadvantage:

"Being in the top 10% or graduating with distinction may be a point against candidates - they will not always be able to relate well with the average client in a first opinion practice"

Finally, the employers' comments supported the fact that they value personal attributes over academic criteria:

"Personality is most important and how they come across at interview - academically all graduates are able to be vets however, some will not have the people skills and confidence of others early on"

6.3.7: Non-academic criteria and recruitment

The majority of respondents agreed that the applicant's CV; the references; previous clinical experience; hobbies and non-veterinary related work would influence their decision to employ a new graduate. Their responses are summarised in figure 6.8.

Analysis of the qualitative comments provided a further insight into the way in which these criteria are used. The CV is often considered important for selection for interview:

"The CV allows us to choose who to interview, but does not largely influence the employment."

More value was placed on references from someone they know and academic references were considered less useful:

"References for a new grad are usually from teaching staff, who want to give a good reflection of their teaching ability."

"If the references are from a vet I know and respect, that carries a lot of weight"

Employers are looking for appropriate clinical experience in practices similar to their own, furthermore having completed CEMS with the employer has secured jobs for some graduates:

"It is good to have someone who has some clinical experience that is relevant eg if all their EMS is equine I will not offer them my SA job"

"Where possible we try to recruit from students who have seen EMS with us."

Finally hobbies and non-veterinary related work is regarded by many employers as an advantage as it is often an indicator of a well rounded person who will fit into their team:

"I read the hobbies bit as usually I think if they like similar things - outdoors and sport, they will fit in with the team!"

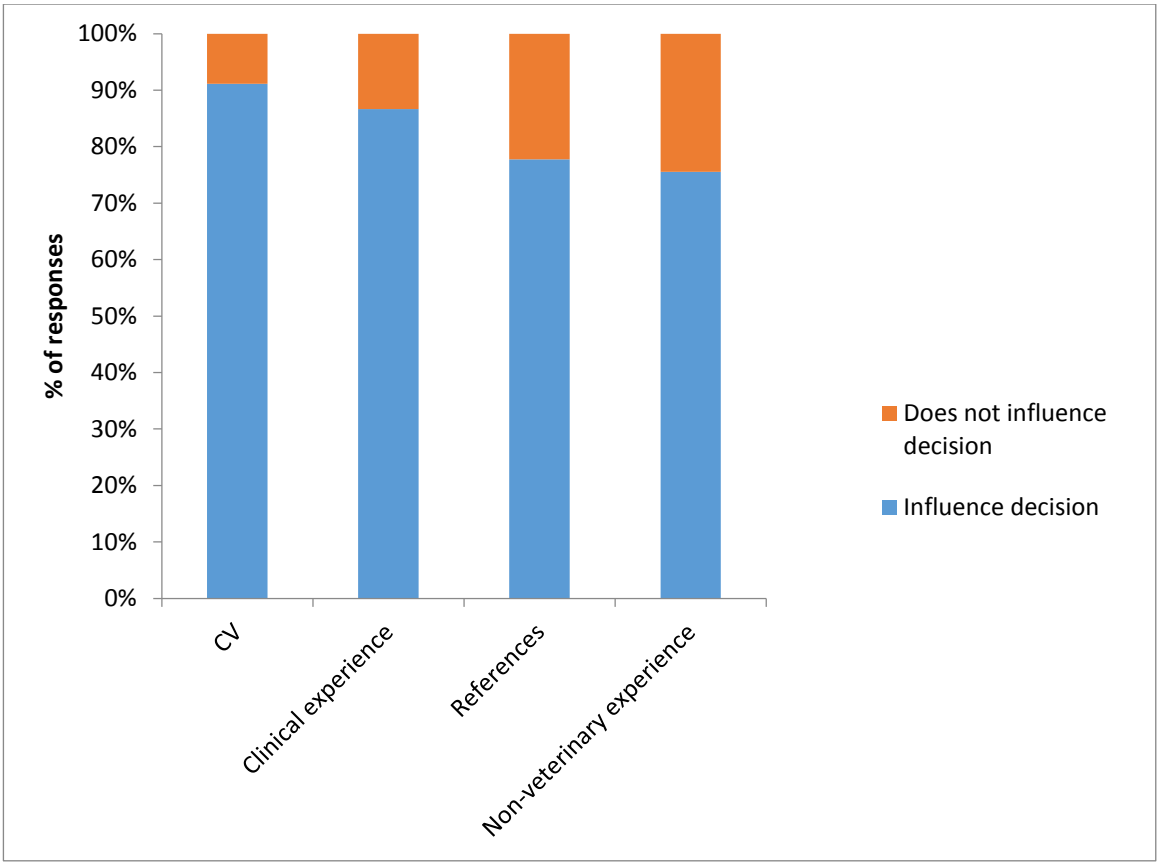

Figure 6.8: Percentage of employers who felt that the CV, references, previous clinical experience and hobbies and non-veterinary related work would influence their decision to employ a new graduate.

6.3.8: Attributes assessed at interview

Interpersonal skills were the most important and commonly assessed attribute at interview, illustrated in figure 6.9. The four respondents who didn't assess interpersonal skills, qualified this by saying they had no formal assessment:

"Depends on the meaning of assess - interviewing is certainly assessing interpersonal skills though I perform no tests"

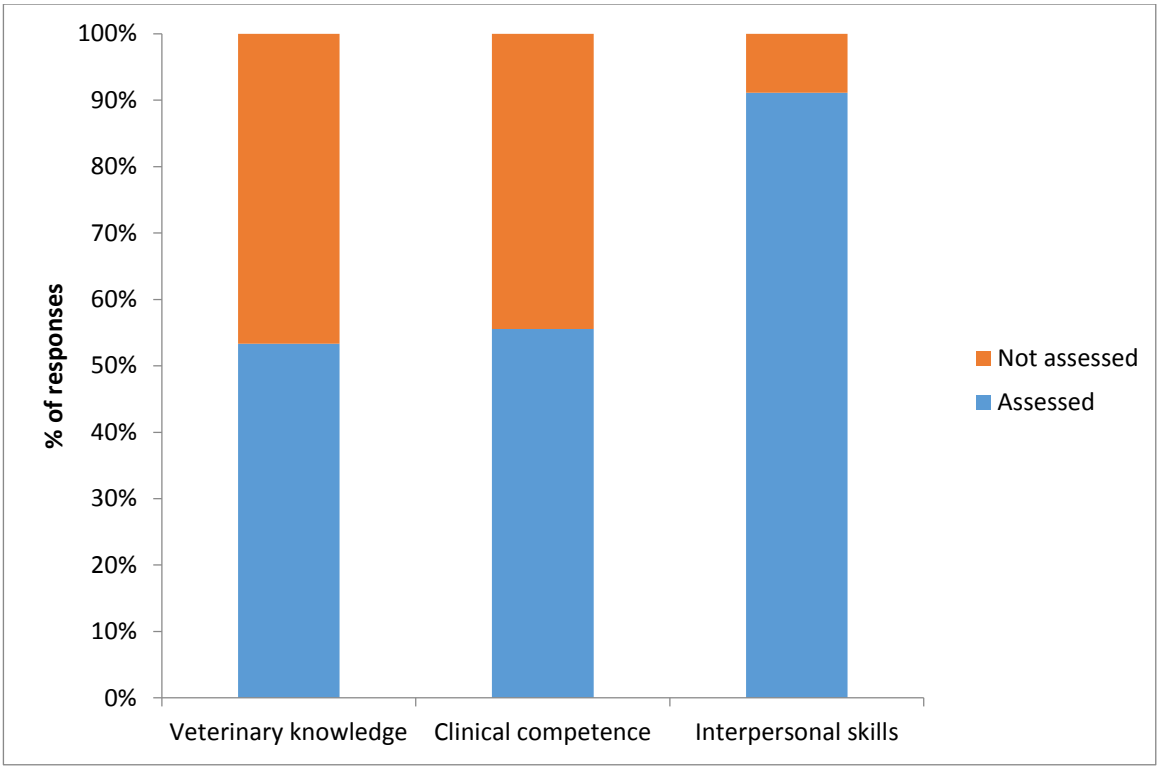

Figure 6.9: Percentage of employers who assess veterinary knowledge, clinical competence and interpersonal skills at interview.

The free text responses showed that some employers felt it was unfair to assess anything other than interpersonal skills in an interview situation and some assumed that being awarded a veterinary degree was proof that new graduates have sufficient knowledge to be able to do the job:

"I have thought about doing a practical test but feel it is unfair and they would be far too stressed to undertake it properly."

"Vet knowledge and a level of clinical competence are assumed from recently passing their exams."

The employers who stated that they assess veterinary knowledge, clinical competence and interpersonal skills at interview, used the following methods of assessment:

- Observing graduates during consultations
- Observing graduates performing clinical and surgical skills
- Questions and discussions around cases and common scenarios in practice
- Case presentations by the new graduate
- Assessment of the graduate during time spent within the practice
- Assessment of interpersonal skills outside of the practice environment, for example taking the graduate out for a meal with some of the practice team.

6.3.9: Influence of the type of practice on new graduate recruitment

Analysis of the results by type of practice according to the species covered showed that employers working in farm animal practice placed highest value on academic criteria (figure 6.10). Employers of farm animal vets were the only respondents to take 'being within the top 10% of their year' into consideration (X^2 (3) = 6.405, p=0.045).

When looking at attributes assessed at interview, employers working in small animal practice were more likely to assess clinical competence (X^2 (3) = 8.487, p=0.037) (figure 6.10).

No other significant associations were found between the type of practice according to species and recruitment of new graduates; figure 6.10 illustrates differences in responses according to practice type.

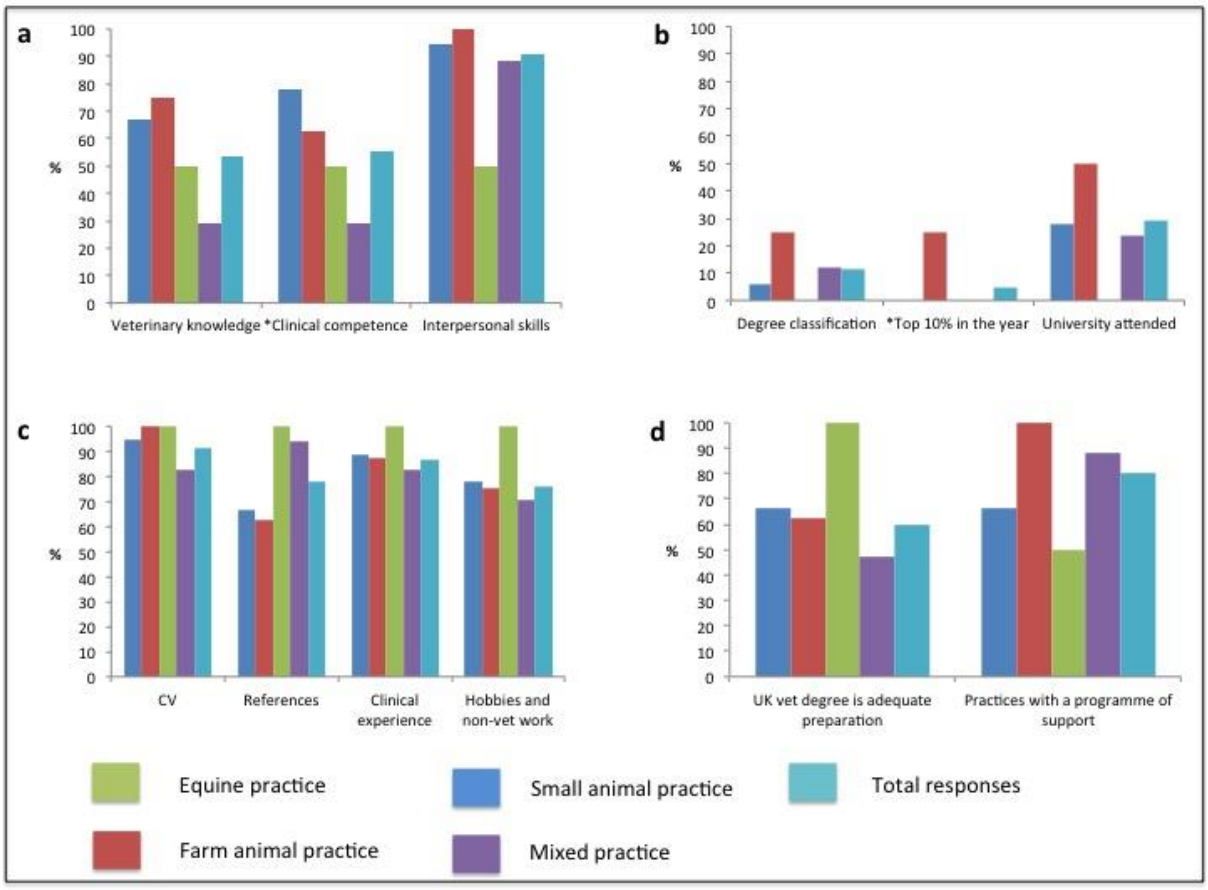

Figure 6.10: Influence of practice type on new graduate recruitment.

(a) The percentage of employers who assess new graduate attributes at interview (b) The percentage who consider academic attributes to be important (c) The percentage who consider non-academic attributes to be important (d) The percentage who agree that the UK veterinary degree is adequate preparation and who offer a programme of support to new graduates

* Highlights a statistically significant difference in responses between practice types

There was no significant association between practices employing vets with post-graduate qualifications and new graduate recruitment; differences in responses are illustrated in figure 6.11. Likewise no significant association was found between practice caseload and new graduate recruitment; differences in responses are illustrated in figure 6.12.

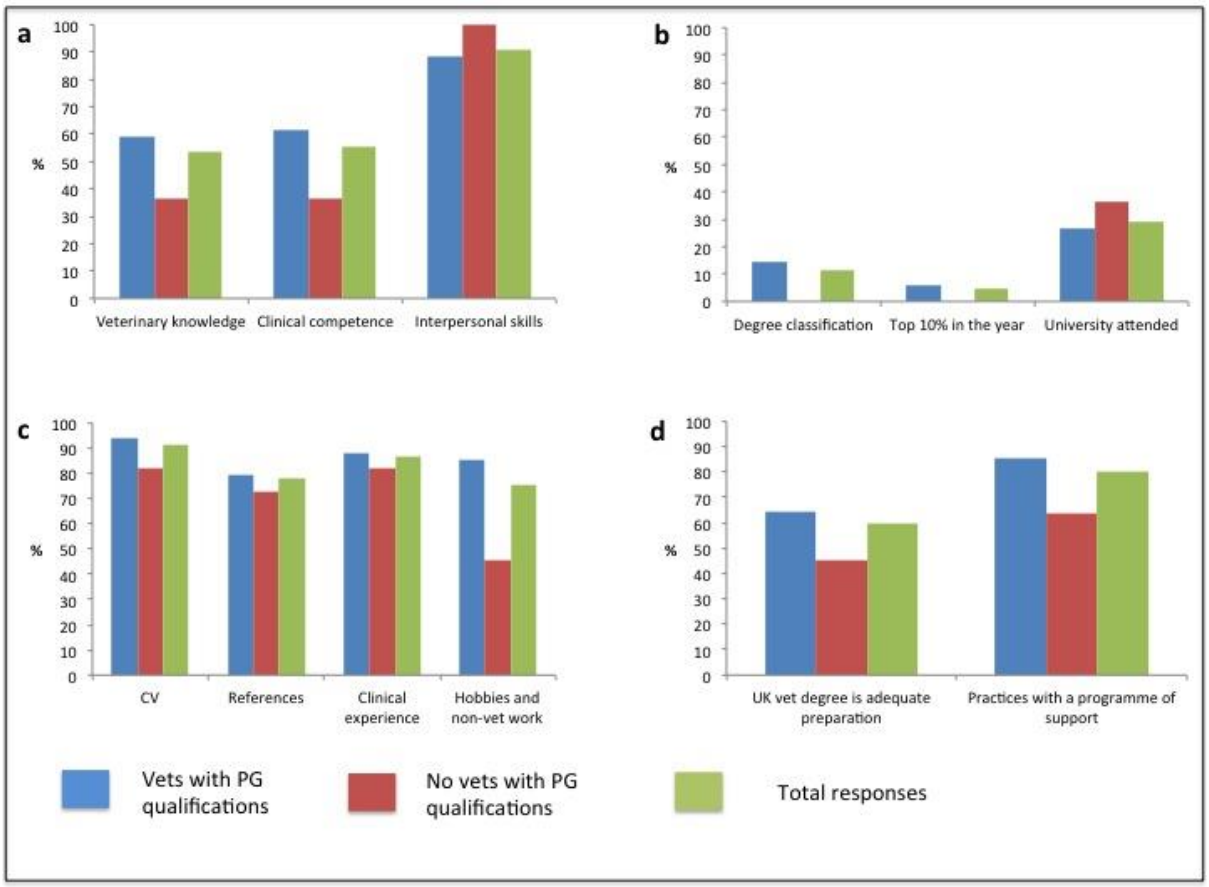

Figure 6.11: Influence of post-graduate qualifications on new graduate recruitment.

(a) The percentage of employers who assess new graduate attributes at interview (b) The percentage who consider academic attributes to be important (c) The percentage who consider non-academic attributes to be important (d) The percentage who agree that the UK veterinary degree is adequate preparation and who offer a programme of support to new graduates

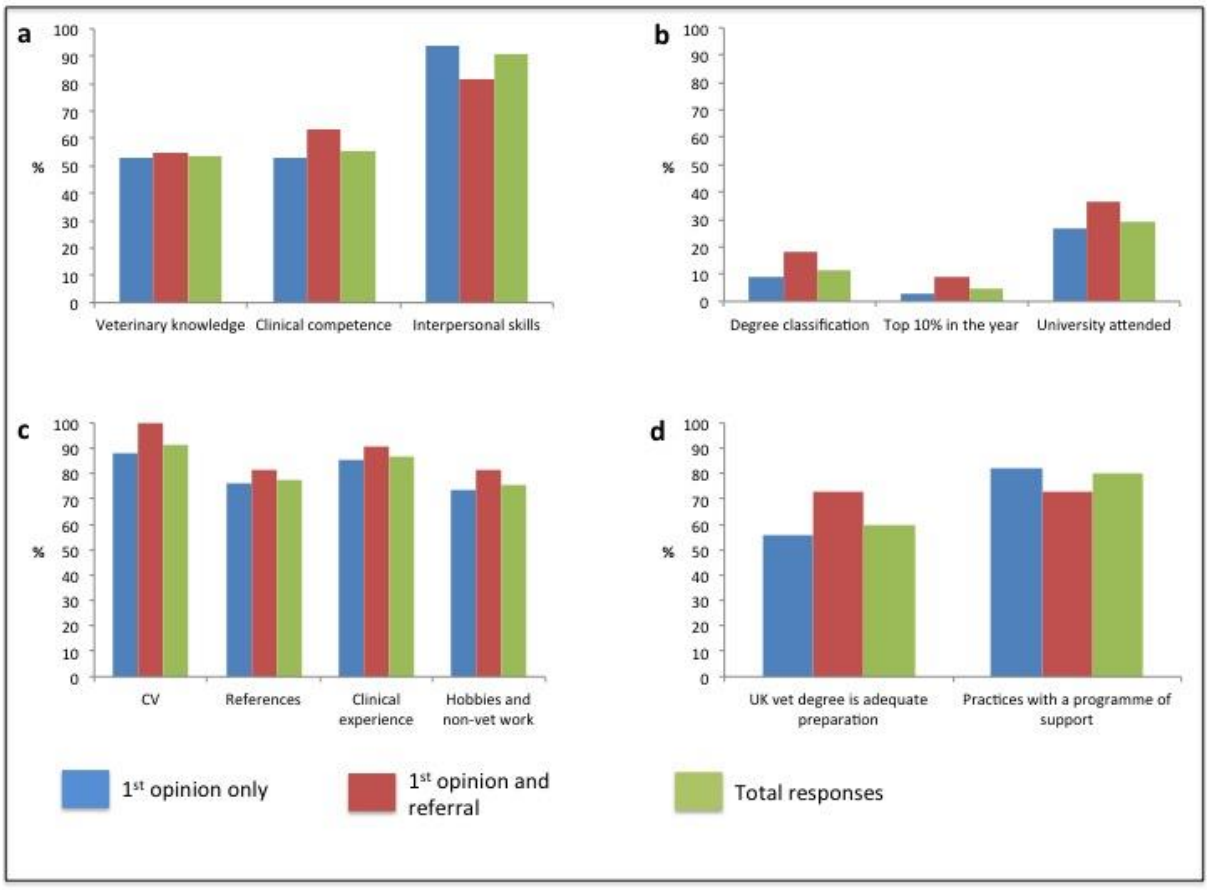

Figure 6.12: Influence of practice caseload on new graduate recruitment.

(a) The percentage of employers who assess new graduate attributes at interview (b) The percentage who consider academic attributes to be important (c) The percentage who consider non-academic attributes to be important (d) The percentage who agree that the UK veterinary degree is adequate preparation and who offer a programme of support to new graduates

6.4: Overview and implications of chapter 6

There were some discrepancies between the employers' and students' perceptions of what makes a successful transition to practice and what employers are looking for when recruiting new graduates. Similar to the findings of previous studies (Rhind et al., 2011) the students placed greater importance on knowledge and understanding. Therefore some students could be placing too much emphasis on knowledge at the expense of developing more generic skills valued by employers. The

employers' opinions are consistent with existing literature on the transition to practice where they have been shown to value clinical experience and interpersonal skills (Routly et al., 2002, Schull et al., 2012, Bonvicini, 2010, Mellanby et al., 2011). However, veterinary knowledge cannot be disregarded; it is a fundamental component of clinical competence and provides the foundations for veterinary education. In their responses some employers suggested that they assumed an adequate level of knowledge amongst UK graduates, provided by their university education. Therefore an appropriate level of knowledge could be equally as important as more generic skills. However, veterinary knowledge is considered less variable than the practical experience and interpersonal skills on which decisions around employment are made. Further study into the importance of different types of knowledge and how it is utilised by new graduates would enable educators to make more informed decisions about curricular content.

This study has highlighted some issues in teaching and learning which appear to impact CA. Clinical experience was the most popular preparation for practice stated by students. Many of them sought additional opportunities to practice day one skills after graduation. This is also perceived by employers to be important in making a successful transition to practice and contributes significantly during the recruitment process. These results suggest that a greater proportion of the course should be dedicated to WPBL. Based on the findings of chapters 4 and 5, more emphasis on WPBL should be combined with an assessment strategy that focuses on WPBA, assessing outcomes related to professionalism as well as the required skills and knowledge for veterinary practice. The likely

outcome would be to drive a deep approach to WPBL with graduates who are better prepared for work as veterinary practitioners.

This study has provided further opportunity to review the ILOs defined in chapter 3. It would be expected that the attributes required for a successful transition into clinical practice should be described within the ILOs of the course and to an extent this is true. However, there were ILOs that were not represented within the responses from employers or students. These areas are still important to the role of a veterinary surgeon but not specified as success criteria in the transition to practice. Although this study did not ask participants to define the outcomes of a veterinary degree course, criteria were identified that were not included within the SVMS ILOs. This finding revealed a potential limitation to the results of study 1: defining the ILOs. A range of stakeholders should be consulted when defining learning outcomes (Harden, 1999, Trent, 2002, Davis, 2003), despite the validation of the list of ILOs, increased student or employer involvement in this process may have resulted in a slightly different set of ILOs.

Deficiencies in the UK veterinary degree identified by the employers are consistent with current literature relating to perceptions of new graduates and the education they receive (Routly et al., 2002, Schull et al., 2012, Bonvicini, 2010, Mellanby et al., 2011). However, these results are not consistent with the findings of the outcomes assessment in chapter 4; graduates felt very well prepared for their role in terms of communication skills, interpersonal skills and teamwork, which were amongst the highest rated course outcomes. This does not reflect the employers' opinion that

so called soft skills are lacking within undergraduate veterinary education. Similar to the findings of Lloyd and Walsh (2002) the employers surveyed also identified financial and business training as an area of weakness within veterinary curricula. Again, based on the outcomes assessment this is another area in which SVMS graduates felt well prepared. However, it may be beneficial to explore the elements of business management essential to new graduates, these could then be prioritised within the curriculum along with the financial considerations which are essential for all graduates to appreciate in case management.

There were some differences in opinions between employers working in different types of practice. Farm animal practitioners in this study were more influenced by academic criteria, which may be partly explained by the increasing competition for farm work amongst new graduates. Support for new graduates was more likely to be offered by the participating farm animal employers and this is perhaps unsurprising due to the ambulatory nature of the work outside of a clinic or hospital environment. Graduates applying to small animal practice are more likely to be assessed on their clinical competence at interview. This is clearly more feasible within a small animal practice situation and graduates should be prepared for this to enable them to perform to the best of their ability. These results are based on a small number of practitioners and certain areas, for example equine practice, are underrepresented. Further work is required to develop a better understanding of employability and success within different areas of veterinary practice and this would enable veterinary students to tailor their learning and preparation according to their career plans.

Preparing students for different areas of veterinary practice will be a challenge for universities in the future. The concept of tracking is a contentious issue within veterinary education and has been previously investigated and debated at length (Crowther et al., 2014a, 2014b, Radostits, 2003, Eyre, 2002, Walsh et al., 2009). Although the current requirements in the UK are for vet schools to produce *omnicompetent* graduates, the results from this small sample of practices suggest that partial tracking could be beneficial for both graduates and employers. Focussing on preparation for a specific area of practice would allow students to build upon key skills and knowledge essential to their role on day one. The use of tracking to improve the employability of graduates and facilitate their transition to practice will be explored in greater detail within the final discussion chapter of this thesis.

Veterinary practices also differ in their caseload. A previous study conducted in Australia found practices that employ vets with post-graduate qualifications more likely to value academic criteria during recruitment of new graduates (Heath and Mills, 2000). Although similar trends were identified in this study, there were no significant correlations. Further investigation with a larger sample of UK employers, particularly those from referral practices, would enable students to be better informed when seeking employment within their preferred area of practice.

Appropriate support is essential to new graduates commencing their career in practice (Gilling and Parkinson, 2009, Routly et al., 2002). The majority of respondents in this survey stated that they provided support for their new graduates. The type of support offered generally relates well

to the areas in which SVMS graduates stated they felt less well prepared, for example support during out of hours work and with surgical skills. Although there were some discrepancies with some employers prioritising communication skills, finance and practice management as areas where support is required, in contrast SVMS graduates felt well prepared with regards to these outcomes. In addition to the limitations of small sample sizes, it should be noted that these responses are from one practitioner who may or may not be solely responsible for providing support or making decisions regarding recruitment of new graduates. Therefore their opinions may not be a true representation of what actually happens during selection and induction of new graduates within the practice.

There are concerns over the generalizability of these results to the wider veterinary profession. However, it was neither the aim of this study nor the research within this thesis to define the characteristics of a successful transition to different types of veterinary practice in the UK. The aim was to identify features of this transition period that may impact the learning behaviour of students as they approach graduation. To summarise, students appreciate that generic, interpersonal skills are important, but seek further clinical experience to improve their day one skills, which is aligned to employers' expectations. The impact of the transition to practice appears to have a positive impact on student learning, however, this is not aligned to all methods of assessment in final year. Finals examinations based on recall of veterinary knowledge may be detrimental to the transition to practice for some students. If this hurdle was removed, the proximity of employment would have a greater impact on

their learning with students more able to focus on day one skills, thus enhancing constructive alignment within the curriculum.

Chapter 7: Discussion

7.1: What is the impact of assessment on CA within the SVMS curriculum?

A discussion of the findings from each of the 5 studies has already been provided at the end of each chapter. This section will recap the main findings and limitations relating to each of the research questions that have led to a proposed model of CA in the SVMS curriculum (figure 7.1). The conclusions are then considered within the wider context of veterinary and healthcare education.

7.1.1: What are the intended learning outcomes of the veterinary medicine course?

Twenty-five ILOs for the SVMS graduate were identified and expressed as a list of knowledge, skills and attributes in chapter 4. The list is comprised of veterinary specific outcomes along with more generic transferable skills and is closely aligned with the previously published studies (Gilling and Parkinson, 2009, Mellanby et al., 2011, Schull et al., 2011) and the SVMS learning outcomes described in the existing course documentation. A limitation to the methods in study 1 is the range of stakeholders involved in defining the outcomes. Whilst SVMS staff and clinicians working closely with the students placed high importance on the outcomes generated, the findings from study 5 suggest that recruitment of students and a broader sample of employers might have resulted in a slightly different list. The ILOs should be regularly reviewed to reflect the changing demands of the profession and the range of stakeholders consulted during this process should be reconsidered (Harden, 1999, Trent, 2002, Davis, 2003).

However, the ILOs generated were used successfully within the graduate survey in study 2 that provided valuable information about the SVMS curriculum as preparation for new graduate veterinary surgeons.

7.1.2: Do teaching, learning and assessment prepare students for the demands of clinical practice?

The results of study 2 demonstrated that most graduates regarded the education they received at the SVMS as good preparation for their career in clinical practice. However, their perceptions of the assessment methods alone were less positive. These results suggest that elements of the SVMS assessment strategy have a negative impact on learning behaviour, and therefore on constructive alignment, resulting in students preparing differently for examinations and future employment. The students rated a written assessment as best preparation for their current roles. This is an interesting finding considering that this format only assesses students at the level of 'Knows how' according to Miller's hierarchical description of clinical competence assessment (Miller, 1990). One explanation could be that the context of the assessments aimed at the levels of 'shows how' and 'does' need to be reconsidered to achieve maximum educational benefit from these formats (Govaerts et al., 2007). There was a lack of significant correlations between undergraduate performance and preparation for practice, which is perhaps unsurprising, although interpretation of these findings is problematic. Whilst the existing literature highlighting issues concerning self-assessment should be considered (Doucet and Vrins, 2010, Woolliscroft et al., 1993), these results challenge the purpose of some components of the SVMS assessment strategy previously discussed in chapter 4.

There are several limitations to the conclusions drawn from the results of the graduate survey. In addition to the lack of a direct assessment of graduate performance and the small sample sizes previously discussed, these data represent a snapshot of the graduates' opinions several months after graduation. It is impossible to predict the influence of factors such as their work experience, the support they have received and any CPD they have participated in on their responses. Neither do these results provide evidence for any lasting effects of the SVMS curriculum.

Despite these limitations, elements of the curriculum were highlighted as excellent preparation for practice. For example, professional practice and clinical examination skills were regarded highly. Other areas, such as veterinary public health and emergency care were identified in need of development. These insights provided by the indirect outcomes assessment, have led the SVMS management team to adopt the graduate survey as part of the School's annual curriculum evaluation process.

7.1.3: What is the impact of assessment methods, used in the final year of study in veterinary medicine, on learning behaviour?

Three assessment formats were studied in depth, the MCQ, SCT and DOPS, different learning behaviours were seen as a consequence of each format. The more authentic assessment formats appeared to elicit more desirable learning behaviour, whereas the MCQ was perceived by many as a test of short-term memory and resulted in rote learning. However assessment related factors, for example the timing, different assessors, the consequences and the purpose of assessments were found to have more influence on learning behaviour than the format *per se*. These

findings are aligned to those of a previous study in medical students (Cilliers et al., 2010).

The educational impact of the assessments was usually described in preparation for an examination. The catalytic effect described by Norcini et al. (2011) was less apparent, suggesting a need for more effective student feedback that acts as a trigger for deep learning approaches. Although there was some evidence of the feedback from DOPS having a positive impact on WPBL, improvements to the assessment strategy through increased observation of student performance and subsequent feedback could enhance this effect. Therefore greater emphasis on effective feedback in conjunction with a review of the assessment timetable has the potential to achieve greater CA resulting in students adopting a more consistent deep approach rather than resorting to surface strategies in preparation for exams.

The SCT was shown to have high face validity but more importantly resulted in students drawing on their clinical experience and functional knowledge to make clinical decisions. The students considered the SCT to be an effective assessment of clinical reasoning and also helpful in the development of their clinical reasoning skills. However, consistent with the findings of the DOPS, some of the educational benefits were countered by the implementation of the test and the lack of understanding of both students and the expert panel on the purpose and mechanics of the format. Attempts to resolve this issue are currently being investigated by the teaching, learning and assessment committee.

One of the criticisms of the methods used in studies 3 and 4 could be the hierarchical relationship of the researcher with the student participants. The role of the researcher in teaching and assessment within the school could have led to a reluctance of the students to talk openly about the curriculum and potential bias in data analysis. However, as discussed in chapter 3, this potential flaw was recognised from the outset and a reflexive approach was adopted. On reflection, the students did not appear to hold back when voicing their opinions regarding assessment and strategies such as collaborative coding reduced any bias during the analysis of qualitative data. Another limitation is that these data represent the students' perceptions of assessment and their educational effects. Direct measurement of their learning approaches through observation or learning diaries might have yielded different results. However, interpretation of results from these methods can also be problematic (Halbach, 2000).

Despite these limitations the conclusion that the format is less important than the way in which the assessment is used reflects a shift in research on assessment in healthcare education, from a focus on the psychometric properties of individual formats to the context and interpretation of each assessment within the overall strategy (Norcini, 2013, Govaerts et al., 2007, Kane, 2013).

7.1.4: What is the perception of final year students and employers of new graduates of the requirements for a successful transition to practice?

The students placed more importance on the role of knowledge and veterinary specific skills in their transition to practice compared to the employers. However, the students did appreciate interpersonal skills, communication and professionalism, which are valued by employers and essential for the role of a practising veterinary surgeon. The employers' view in this study that knowledge is less important than some transferable skills when recruiting new graduates was consistent with previous findings (Routly et al., 2002, Schull et al., 2012, Bonvicini, 2010, Mellanby et al., 2011). However, there seemed to be an underlying assumption amongst employers that the universities would equip students with an appropriate knowledge base. Therefore upon graduation employers could focus on the clinical and transferable skills that they do not consider to be sufficiently covered in veterinary degree courses. There also appears to be a mismatch between the employers' perception of graduates' transferable skills and graduates' own perceptions of how well prepared they feel in these areas. Perhaps further integration of private practice with the universities would provide employers with the opportunity to have more influence over undergraduate training and also enable a greater appreciation of the recent changes to veterinary curricula.

Both students and employers saw clinical experience as important preparation for the transition to practice. Many students sought additional opportunity to improve their day-one skills prior to finding employment. It appears therefore that during final year the imminent transition to

practice has a positive impact on students' learning behaviour and therefore on CA. Students reflect on their own ability and identify opportunity for the deliberate practice that they perceive and others have shown to be essential for success (Ericsson, 2007). In the current assessment strategy, this effect is opposed by the impact of the finals examination and this might account for the increased importance placed on knowledge by the students compared to the employers.

Some differences were identified in the opinions of employers from different types of practice, although these results should be interpreted with caution due to low numbers of participants representing these groups, for example, within equine practice and referral institutes. The impact of career choice on the transition to practice warrants further research, this would facilitate universities in designing programmes that prepare students for future employment.

As with the previous studies, non-random sampling and small sample sizes limit the generalizability of these findings. Perceptions of graduates and employers are not direct measures of success, however observation of new graduates in practice and measurement of their performance against success criteria would be challenging within the current structure of the profession. The opinions of employers and final year students were sought in this study; consideration of the views of all members of the practice team might have led to different results. Another important measure of new graduate success might be client satisfaction as they are often best placed to judge patient outcomes that are arguably the most important criterion for assessing success in practice (Asch et al., 2009).

7.1.5: A proposed model to illustrate the impact of assessment on CA.

The results of the research within this thesis have identified the effects of individual assessment formats on student learning. However, visualising the overall impact of the assessment strategy on the SVMS curriculum is challenging. Figure 7.1 has been created in an attempt to illustrate the author's opinion of the impact of assessment on CA following this research. In the ideal model of CA, the ILOs and the SLOs are closely aligned (represented in figure 7.1 as grey bands at the beginning and end of the curriculum). Professional, knowledge based and practical learning objectives are delivered throughout the five-year course (vertical black lines). Teaching, learning (blue discs) and assessment (dark red bands) are designed to allow students to develop in all three areas.

The traditional model does not necessarily represent a current veterinary curriculum; it is based on reports of traditional curricula and the author's personal experience of veterinary education in the UK. It should be acknowledged that in many schools across Europe and North America, assessment strategies now exist with the aim of assessing clinical skills and professionalism throughout the curriculum. In this traditional model teaching, learning and assessment are focussed on knowledge-based objectives and are not aligned with any ILOs; this results in variable SLOs (shown in yellow). Variation is dependent on contextual factors such as case exposure, supervising clinicians and the unique hidden curriculum integral to each school as well as individual learning preferences. Deficiencies in certain areas, mainly professional and practical skills (shown in red) are the result of a lack of CA. Variation and deficiencies in

ILOs are not quantifiable and the actual width of these bands are not intended to accurately represent a given number of learning outcomes, they are intended to provide a comparison between models.

The proposed SVMS model shows graduates as having some variation in the SLOs, this is inevitable given the contextual factors described above. The outcomes based approach has led to greater emphasis on professionalism and practical skills within the curriculum resulting in fewer gaps in these areas. However the assessment strategy encourages students to focus on knowledge acquisition that is perceived as essential for success in examinations. The alignment of outcomes related to professionalism is not entirely clear (red and yellow hatching), on the one hand graduates felt well prepared in areas of professionalism, communication and interpersonal skills, however, employers still perceive graduates to be less well prepared in these areas. In addition the portfolio assessment received mixed reviews, some students rated the portfolio as poor preparation for practice and the impact on their reflective and professional skills is not clear.

This model represents the author's opinion on CA within different veterinary curricula following investigations of learning behaviour, students' perception of assessment and graduates' perceptions of preparation for practice. Other methods exist to enable judgements to be made regarding the alignment within a curriculum. For example, curriculum mapping has been shown to be an effective method of evaluating and maintaining alignment of the declared curriculum (Bell et al., 2009a, Harden, 2001). The University of Nottingham curriculum

mapping tool is used within the SVMS to map session learning objectives to the course outcomes written in the programme specification, the RCVS and the EEAVE accreditation criteria. Any changes to learning objectives are approved by the teaching, learning and assessment committee before being changed within the curriculum map. This process enables monitoring of the declared curriculum to prevent curriculum drift and maintain alignment.

Additional methods exist within the SVMS to monitor curriculum alignment. An overview of this process has been provided in figure 2.3 within chapter 2. One important stage in this curriculum review cycle is the analysis of the results of direct student assessment. Classical test theory is used to produce measures of difficulty and discrimination. Areas where students have performed less well are fed back to the module convenor for consideration at the module review. Teaching and learning activities and assessment items can then be modified, if appropriate, to maximise alignment of student and intended learning outcomes.

The author acknowledges that different conclusions might have been made regarding the alignment of the SVMS curriculum, based on analysis of the curriculum map or results of direct assessments. However, the research within this thesis was concerned with the alignment of the learned curriculum and subsequent achievement of ILOs. The conclusions drawn regarding CA and the proposed model in figure 7.1 are based on these findings.

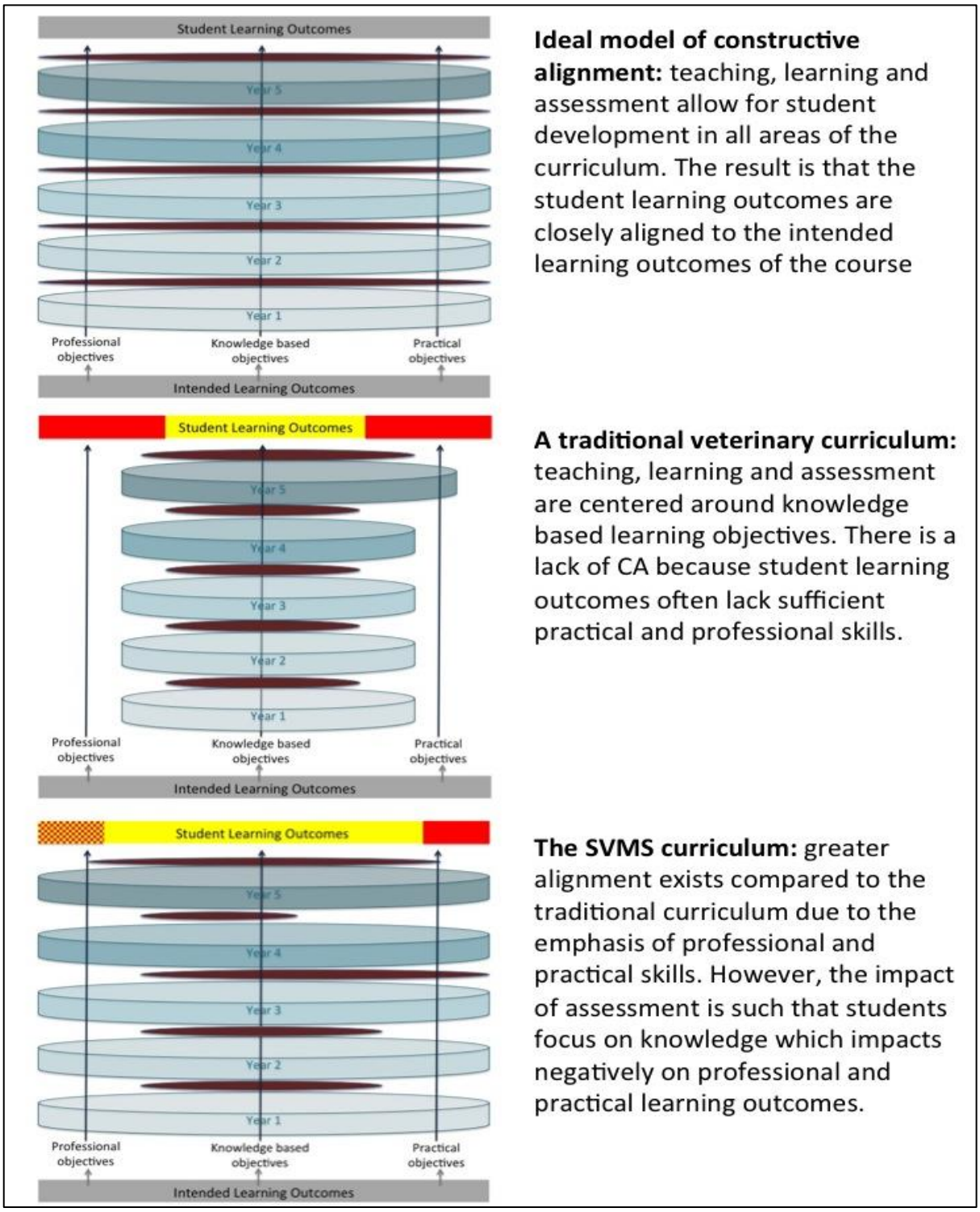

Figure 7.1: Three proposed models of constructive alignment.

The ILOs (grey) are used to construct learning objectives that are delivered throughout the 5 years (vertical black arrows). The blue discs represent teaching and learning, the dark red bands represent assessment. SLOs are shown in grey in the ideal curriculum, red and yellow outcomes represent variation in student outcomes. Further explanation is provided in the main text.

7.2: Implications of the research for assessment strategies

7.2.1: Programmatic assessment

A significant outcome of this research is that the purpose and implementation of assessment are far more influential on learning behaviour than the choice of format. Historically, research into assessment of clinical competence has focussed on the psychometric properties of individual assessments and educators have become focussed on selecting reliable and valid formats (Regehr et al., 1998, Valentino et al., 1998, Cook and Beckman, 2009, Hecker et al., 2010, Auewarakul et al., 2005). However, this has often led to objectification of assessment criteria, which does not automatically result in increased reliability or validity and can have detrimental effects on student learning behaviour (Van Der Vleuten et al., 1991, Van Der Vleuten and Schuwirth, 2005). Over emphasis of objectivity and the consequences of high stakes assessments of performance may be responsible for the students' and graduates' perceptions of the assessments of 'shows how' and 'does' within this research. More recently a focus on programmes of assessment calls for a blend of assessment methods which sample broadly across a range of competencies and provide meaningful feedback to the learner (Van Der Vleuten and Schuwirth, 2005, Govaerts et al., 2007). Issues of reliability are overcome by sufficient sampling to address the concept of case specificity, regardless of the assessment format, and assessor variation should be regarded as judgement not an error (Gingerich et al., 2011). High stakes decisions should not be made based on the results of

one assessment point (Govaerts and Van Der Vleuten, 2013) and inferences made about the scores are more important than the details of the response format when considering validity (Kane, 2013). These current recommendations regarding competence assessment broadly support the conclusions drawn from the research within this thesis: lowering the stakes and increasing opportunity for observation and feedback, with increased emphasis on assessment at the level of 'does' (Miller, 1990), will have a positive impact on learning behaviour and improve CA within the curriculum.

7.2.2: New perspectives on WPBA

Providing further assessment opportunities at the 'does level' will involve an increased use of WPBA. The relationship between WPBA and WPBL appears more closely integrated than classroom based learning and more traditional forms of assessment. Due to the ongoing nature of WPBA and opportunistic sampling, assessment becomes part of everyday practice and therefore cannot be separated from the learning experience. It is therefore essential that students and staff perceive WPBA to be a valuable tool for both the development and assessment of clinical competence. Lack of engagement of staff results in a decrease in the quality of feedback to students (Nair et al., 2012, Bindal et al., 2011) thus compromising the catalytic educational benefits. For the students WPBA has the potential to become a tick-box exercise where many adopt a strategic approach to meet the assessment requirements, often selecting assessors they consider to be less harsh. Concerns over assessor variation are not unique to students and attempts have been made to identify the sources of assessor variation and minimise its effects (Crossley et al.,

2011, Govaerts et al., 2013, McGill et al., 2011). Following reports of low reliability Govaerts and Van Der Vleuten (2013) challenge the psychometric analysis of WPBA and propose that it is viewed as a socially situated interpretivist act. They suggest that in addition to case specificity, performance also varies due to social and contextual factors. Assessors cannot be seen as passive measures of clinical competence, they construct their own viewpoints and are also influenced by multiple, contextual factors (Kogan et al., 2011). Therefore when considering clinical competence the concept of a true score existing across all contexts, which is fundamental to psychometric analysis, is less likely. Multiple judgements from different assessors should be used to build a picture of an individual's performance rather than relying merely on standardisation of the assessors and the process to enhance reliability (Steinert et al., 2009).

The value of WPBA lies in the interaction between assessors and students and the feedback provided, rather than any quantitative measure of competence (Norcini, 2013). If these interactions are to successfully enhance WPBL, the clinical environment must be considered; there is evidence to support the claim that the quality of care provided within a training hospital affects the trainees' clinical performance post-graduation (Asch et al., 2009, Sirovich et al., 2014). Clinicians as educators must be exemplary role models and the desire to teach is essential (Al Kadri et al., 2011). To provide an appropriate clinical environment to optimise WPBA, with effective relationships between trainees and assessors, a change to the way in which many practitioners regard clinical teaching and assessment is required.

Programmatic assessment comprising multiple low stakes WPBAs has been successfully implemented within a veterinary curriculum in the Netherlands (Bok et al., 2013). The authors conclude that the programme enhanced assessment for learning through increased social interaction including peer feedback, however, implementation was challenging and required extensive staff training to ensure meaningful feedback.

It might be helpful for educators to consider the language used in WPBA to construct assessment criteria and deliver feedback to students. Ten Cate (2005) introduced the concept of entrustable professional activity (EPA) within post graduate medical education. EPAs were designed to bridge the gap between assessment of clinical competencies and feasibility in a hospital environment. They describe tasks which the trainee can perform without supervision (Ten Cate, 2013). Using the level of supervision required to make judgements on trainees' performance could be helpful to assessors within veterinary education, and might also provide more meaningful feedback to students.

7.2.3: Assessment literacy

In addition to educating assessors, increasing the students' understanding of assessment can be helpful to achieving CA. Assessment literacy is described by Smith et al. (2013) as:

"Students' understanding of the rules surrounding assessment in their course context, their use of assessment tasks to monitor or further their learning and their ability to work with the guidelines on standards in their context to produce work of a predictable standard."

Improving assessment literacy enables students to appreciate the role of assessments in the development of clinical competence and to evaluate their own progress, which is essential to lifelong learning. These skills allow students to develop a learning approach appropriate for achieving the ILOs and have been shown to impact positively on performance (Price et al., 2012, Smith et al., 2013).

Improving assessment literacy amongst students is important, although learning behaviour is largely dependent on the students' perceptions of an assessment format. A focus on the MCQ format from year one, could result in deeply motivated students being at a disadvantage in the current SVMS system where surface strategies appear to be associated with examination success. Perceptions are based on prior experience of the assessment and its consequences, other students, staff and finally official SVMS documentation. Assessment literacy could be beneficial in changing the perceptions of the MCQ examination as an assessment of knowledge recall. However, the impact of an assessment literacy intervention at final year is likely to be minimal if the students' experience of the MCQ format in previous years remains unchanged. Therefore the MCQ assessments in years one to four needs to focus on functional knowledge applied to clinical problems and less on recall of declarative knowledge. A more contextualised assessment of knowledge is likely to be more aligned with the ILOs of the course and encourage deep learning approaches. The introduction of a progress test could be beneficial where students are exposed to high level, case-based MCQs each year from the beginning of the course. Longitudinal feedback on performance is provided and this

type of testing has been associated with increased independent and desirable learning strategies (Van Berkel et al., 1994, Blake et al., 1996).

7.2.4: Evaluation of the assessment strategy

The research in this thesis is concerned with CA and in particular the relationship between undergraduate assessment and graduate outcomes. Therefore one important question to consider is "Will these proposed changes to the assessment strategy result in graduates feeling better prepared for practice?" However, improving how well prepared graduates feel doesn't provide evidence of better performance in practice. This type of predictive validity is problematic, in medical education relationships between undergraduate performance, postgraduate training assessments and measurements of patient care have been explored (Hamdy et al., 2006, Tamblyn et al., 2002). However, claims over predictive validity rely on the criteria used for comparison being a valid measure of performance, this is open to challenge considering recent opinions regarding the validity of in training assessments (Kane, 2013, Govaerts and Van Der Vleuten, 2013). In veterinary education predictive validity is even more difficult to demonstrate with a lack of postgraduate training and assessments. Therefore although predictive validity may be a desirable concept to evaluate undergraduate assessments, it may not be feasible to measure in any meaningful way. Despite the challenges associated with measuring success in practice, support and training for veterinary graduates cannot be ignored and is the subject for discussion in the next section.

7.3: The transition from veterinary student to veterinary surgeon

The transition from student to practitioner will always be a challenging period for newly qualified vets. A major concern for new graduates is accepting responsibility for cases and the clinical decisions they are required to make. Veterinary clinical practice entails a variety of different roles requiring different skill sets, in addition veterinary surgeons are required for a number of positions outside of veterinary practice and so preparing graduates for their potential future careers is problematic. One criticism of the veterinary profession is the lack of consistent support and supervised training for new graduates. Although initiatives exist which offer support to graduates (Boulton and McIntyre, 2012, Hunting, 2007) these rely on individuals actively seeking further guidance and support and are not mandatory. The introduction of the compulsory professional development phase (PDP) by the RCVS (RCVS, 2007) is a step towards improved support for all graduates. However this is still far removed from the continuum of medical education, in which postgraduate training continues to provide a focus for educational research and development (Calman et al., 1999, Ovseiko et al., 2014).

As the veterinary profession continues to expand and evolve in the 21st century it is not clear what competent practice will involve for vets of the future. Whilst a more structured approach to postgraduate training would be beneficial, it is essential that we also equip graduates with lifelong learning skills in order that they can continue to develop within the profession providing the best possible care for the animals under their

care. Lifelong learning is undoubtedly important for all vets, it is required by the RCVS for day one competency and due to the diversity of the role of the veterinary surgeon it is essential for those changing careers within the profession. Veterinary curricula have been criticised for lacking in transferable skills such as lifelong learning, communication and interpersonal skills (Routly et al., 2002, Schull et al., 2012, Mellanby et al., 2011). There has been an emphasis on the delivery and assessment of professionalism and transferable skills within the personal and professional skills modules at the SVMS. This appears to have been successful in that graduates perceive themselves to be prepared for these aspects of practice, however the extent of the impact of these interventions on the transition to practice is unclear. Alignment of teaching and assessment of veterinary professionalism with the requirements for practice will undoubtedly be the subject of future research of veterinary education.

In addition to these transferable skills, there are domain specific skills that are essential for success and these will differ according to the type of practice in which a graduate is working. Veterinary educators face the challenge of maintaining a balance of veterinary specific and non-specific skills within their curricula. Furthermore the requirement for graduates to become competent across species areas is becoming increasingly problematic. With a continually expanding knowledge base in all areas of veterinary science, the concept of tracking has been the subject of research and debate within the profession. These issues will be considered in the following section in which changes to the SVMS curriculum are proposed.

7.4: A veterinary curriculum for the future

The outcomes-based SVMS curriculum has been largely successful at preparing graduates for the challenges of veterinary practice. The proposed changes focus on increasing the proportion of WPBL within the course, more emphasis on functioning knowledge and decreasing the delivery and assessment of declarative knowledge. Table 7.1 provides a summary of the proposed changes that are aimed at improving CA within the curriculum. Figure 7.2 illustrates an overview of the current SVMS curriculum and the proposed curriculum incorporating the suggested changes.

Curricular component	Proposed change	Reason for the change
Learning outcomes	Ensuring all learning outcomes for sessions are aligned with the ILOs of the course will reduce some of the content across all modules	Despite an outcome based approach there is evidence of content overload resulting in students focussing primarily on retention of declarative knowledge that could be accessed through appropriate use of resources.
Teaching and learning methods	A decrease in the number of lectures in the course delivering declarative knowledge. Fewer, signposting lectures, used for functioning knowledge.	The content and delivery will be more closely aligned with the ILOs of the course
Modules	All will be streamlined and consolidated	To reduce content overload and over emphasis of recall of knowledge
	Learning outcomes from the practical techniques module to be integrated	Emphasize clinical skills within 3rd and 4th year in preparation for WPBL. At present there is less emphasis and no

	and delivered within the clinical modules in year 4	assessment of practical skills within the clinical systems modules. Addition of a practical assessment will drive learning and result in students being better prepared for rotations in terms of clinical skills as well as clinical knowledge. Integration will allow students to contextualise the skills with the clinical science.
	Year 4 VPH module removed and all VPH delivered through WPBL with some topics integrated into Y3 and 4 clinical modules	Theoretical delivery of VPH has been poorly received because students fail to see the relevance of the subject at that stage. Students place more value on VPH teaching within the rotations.
WPBL	Increase time spent on clinical rotations from 12 to 18 months	Students, graduates and employers all value clinical experience as preparation for practice
	WPBL split into 12 months core rotations and 6 months track rotations	12 months core rotations in existing clinical associate practices will allow development in all species areas as required by RCVS. 6 months track rotations will be delivered outside of existing clinical associates to allow simultaneous delivery of Y4 and Y5

		WPBL. The aim of this is preparation for day one in their chosen area of veterinary practice
Assessment	Remove the finals examination at the 'knows how' level and increase observation and feedback through WPBA	This will remove the conflict between preparing for exams and preparing for performance in clinical practice, therefore enhancing alignment of assessment with the ILOs. Increased WPBA will provide more feedback to students and richer information on student performance at the 'shows how' and 'does' level. This information will be collated and used to make decisions around graduation.
	Years 3 and 4 practical assessment	Integration of the practical skills module will enable emphasis on teaching but also assessment of practical skills in preparation for clinical rotations.
	Years 3 and 4 'knows how' assessment will include the MCQ and SCT questions from the previous finals	No additional knowledge based content is delivered during rotations, therefore with appropriate standard setting this examination will provide a more authentic assessment of

	examination.	knowledge in preparation for clinical rotations
	Implementation of a progress test, using clinically relevant, case based questions	To show individual development throughout the course and also change students' perceptions of the requirements for knowledge based examinations

Table 7.1: Proposed changes to the SVMS curriculum

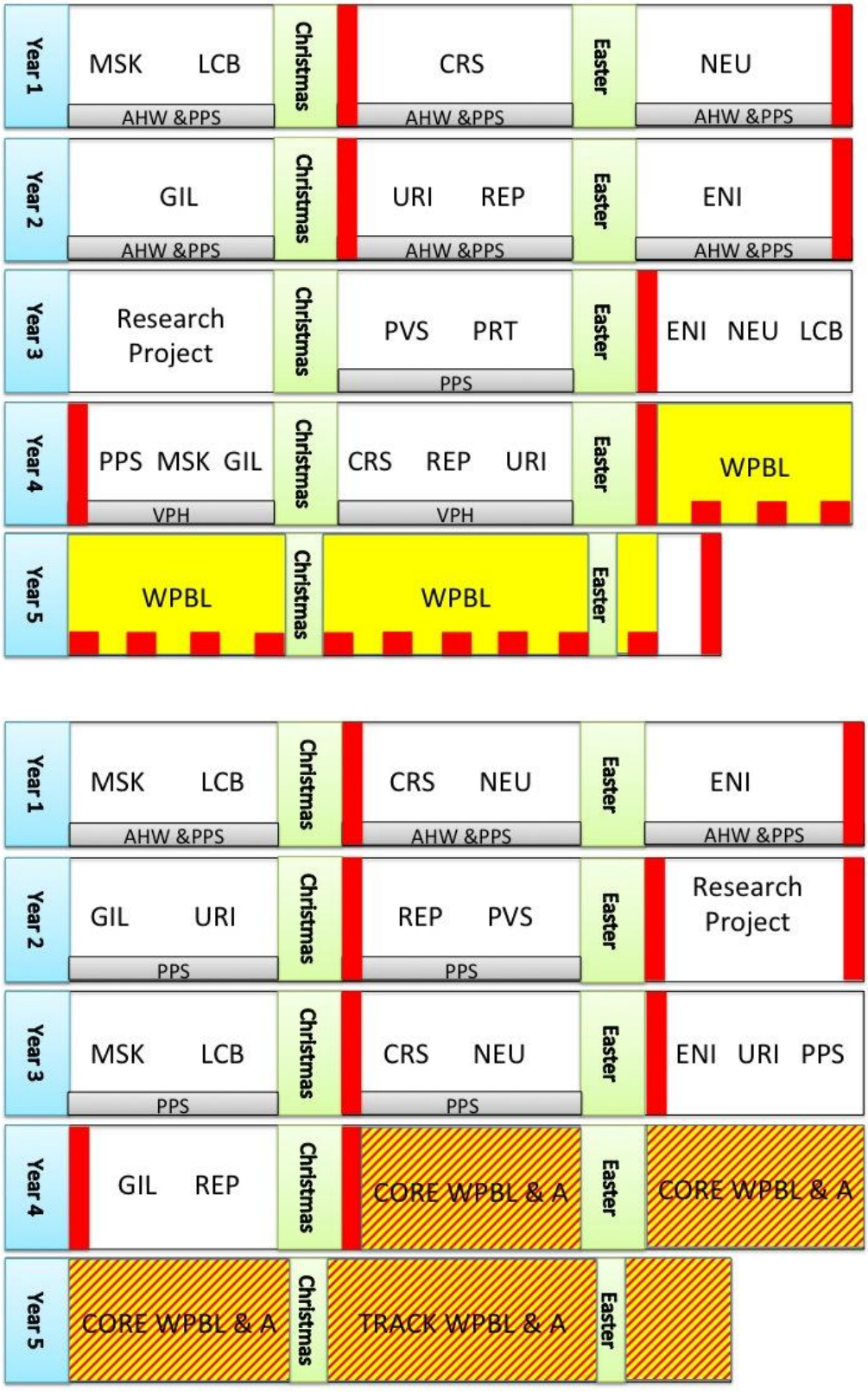

Figure 7.2: An overview of the current SVMS curriculum (top) and the proposed curriculum (bottom).

The major change in this proposal is the increase in WPBL to enable a six months tracked rotation in which the student selects the area of practice in which they would like to work. The aim of this rotation would be to provide students with additional experience of working in first opinion practice in order for them to improve their clinical skills and ability to manage the types of cases they will encounter as a new graduate. In addition the rotation would provide increased opportunity to develop the essential interpersonal and professional skills within a practice environment. The aim would not be to expand students' knowledge of specialist practice through observation of a referral caseload in a hospital environment. However, in addition to the obvious species area tracks, there would be potential to offer minor tracks, one of which may be referral practice, aimed at preparing students who wish to apply for internships and are planning a career in specialist practice.

This concept of tracking within veterinary curricula has been previously explored (Eyre, 2002, Radostits, 2003, Walsh et al., 2009, Crowther et al., 2014a, 2014b) and both partial and full tracking has been suggested. Partial tracking involves a core curriculum whereby graduates obtain a full license to practice in all species areas; for a smaller percentage of the curriculum students select their preferred species area or track to focus on. Full tracking requires the student to select their preferred track much earlier in the course or on application; as the majority of the course is devoted to one area graduates are awarded a restricted license to practice in their chosen field. Whist there have been reports of tracked curricula (Eyre, 2002, Walsh et al., 2009) the majority of veterinary schools in the

UK devote a relatively small proportion of their time to tracking through elective rotations (Crowther et al., 2014a).

Eyre (2002) describes the specialisation that occurs within engineering undergraduate degree programs and the benefits to students, educators and employers. Within this paper potential advantages of tracking within veterinary undergraduate curricula are also proposed and include more efficient utilisation of resources, improved competence at graduation, reducing irrelevant content within the curriculum, increased student and graduate satisfaction, enhancement of the overall competence of the profession and targeted selection for admission to different tracks. Others have described the potential disadvantages that include the requirement for students to make career choices based on limited experience, graduates are restricted to one area of practice without re-training at further cost, increased administration is required to deliver and assess several undergraduate courses, certain tracks maybe over or undersubscribed and finally many practising veterinary surgeons are still required to attend all species areas within their role as a mixed practitioner (Radostits, 2003, Walsh et al., 2009).

In a survey of practitioners, students and university staff in the UK, the majority of participants disagreed with the idea of full tracking but were in support of partial tracking (Crowther et al., 2014a). Twenty-six per cent of practitioners reported a change in career path following graduation and the career aspirations of students differed from the employment opportunities for graduates. The authors conclude that if tracking is to be

introduced it should be done so with caution and in combination with additional careers advice for students (Crowther et al., 2014a, 2014b).

Veterinary professionals have a strong identity and are proud of the diversity of their qualification. Many practitioners and students will have enjoyed the stories of James Herriott, a mixed veterinary practitioner, who is likely to be responsible for inspiring generations to join the veterinary profession. However, these stories, based on the experiences of mixed practice over fifty years ago, almost certainly do not reflect the requirements of the profession today. It is therefore time for change and for veterinary educators to accept the current demands on graduates. Partial tracking within this proposal would ease the transition to practice and increase employability. Additional case responsibility for students, with feedback from an experienced mentor would provide further insight into the challenges and requirements for independent clinical practice.

7.4.1: Risks associated with the proposed curriculum

The proposed new curriculum described in table 7.1 and discussed within this section involves some major changes to the current curriculum. Inevitably, such major changes have associated risks which must be considered prior to their implementation. The changes and associated risks are described in table 7.2

Proposed change	Associated risk
Alignment of session outcomes with the ILOs of the course	**Low risk:** This work is ongoing with embedded module convenors to identify and address areas of content overload.
Reduction in the number of lectures	**Moderate risk:** This is likely to result in poor feedback from some students who prefer didactic teaching and associate more self-directed methods with uncertainty. Resistance from teaching staff due to additional work involved in re-designing existing teaching material
Removal of content from some modules	**Moderate risk:** Could receive criticism from external advisors and accrediting bodies. Poor feedback from EMS providers if there is an apparent difference in knowledge of

	SVMS students compared to those from other UK vet schools
Integration of the practical techniques module	**Moderate risk:** Poor student feedback as they enjoy this block module. This has provided timely practice of clinical skills before CEMS therefore could impact the reputation of SVMS students and EMS provider feedback
Integration of the veterinary public health (VPH) teaching	**Moderate risk:** Integration of VPH as a compensatable topic is likely to be perceived poorly by accrediting bodies, especially considering the emphasis of VPH teaching within Europe. However, graduates require an additional OV (official veterinarian) qualification for VPH work within the UK Student feedback will almost certainly be positive
Increase in the time spent on WPBL	**High risk:**

	Increased pressure on clinical associate practices could jeopardise the relationship with the SVMS Students are often uncertain about their preferred area of practice as undergraduates and would need support in selecting a track
Replacement of final examination with WPBA	**High risk:** Program level assessment does not fit within the existing university structure. Lack of a final examination to assess knowledge could receive criticism from accrediting bodies. It could be problematic finding sufficient opportunity for all students to create a reliable WPBA on which to base high stakes summative decisions
Introduction of practical assessment to year 4	**Moderate risk:** Increased assessment burden for students. Increased assessment and

	administrative burden for SVMS staff
Contextualisation of years 3 and 4 written assessments	**Low risk:** Could receive poor student feedback post examination. This could be avoided through appropriate formative assessment and assessment literacy interventions
Implementation of a progress test	**Low risk:** This could be avoided through assessment literacy interventions.

Table 7.2: The risks associated with each of the proposals for the new curriculum

7.5: Implications of the findings for veterinary education and future work

The research within this thesis was conducted in the context of one university and with a sample of participants from three cohorts of veterinary students. It is therefore important to consider which of the main findings might be generalizable to the wider context of veterinary education. The following sections, in the authors' opinion, provide a summary of the conclusions drawn from the research that veterinary educators in other institutes may relate to and find useful. Suggestions for future research are also provided.

7.5.1: Outcomes assessment

Alumni surveys as indirect assessment of learning outcomes provide valuable information for the process of curriculum review and development. The ILOs of the course must be regularly reviewed and a variety of stakeholders should be involved in this process. Feedback from students and graduates on the direct assessment of outcomes should be utilised to ensure optimal alignment of assessment with the ILOs of the course.

Future developments within OA should include the opinions of employers, colleagues and clients regarding the performance of new graduates. Longitudinal studies would be beneficial to explore any lasting effects of undergraduate education. Whilst valid measurements of performance in practice may be challenging to implement, assessment as part of postgraduate training and support is an area that warrants further

research. The extensive research that exists within medical education might be beneficial in informing future studies within the veterinary profession. Finally a collaborative approach to OA would facilitate the comparison of different curricula and educational interventions.

7.5.2: The impact of assessment on CA

A focus on assessment of declarative knowledge in the early years of the course can affect students' perceptions of assessments in later years. As a result, assessment often has a negative impact on CA. Increasing the authenticity of assessments has a positive effect on approach to learning. In addition the use of WPBA is likely to result in graduates feeling better prepared for practice, however as with all assessments effective implementation is essential. Poorly implemented assessments often impact negatively on CA. WPBA with observation of students' performance and qualitative feedback can provide a framework for clinical teaching however, further research is required into the use of WPBA to make summative decisions in veterinary clinical education. There are areas within the SVMS assessment strategy which haven't been investigated within this thesis, for example, the portfolio. Further investigation into the educational impact of the portfolio within this context would be beneficial to maximise its use in preparing students for a career in professional practice.

7.5.3: Assessment literacy

Staff and students should be engaged with the assessment process and increasing awareness of assessment amongst students can facilitate this.

Particular attention should be given to novel formats such as the SCT that was valued as an assessment of clinical reasoning but a lack of understanding of the format resulted in issues surrounding reliability and acceptability. Careful planning and implementation is essential to ensure feasibility and success of the SCT. Facilitated discussions around assessments and feedback enhance assessment literacy amongst students and also provide an opportunity to collate students' opinions to enable a better understanding of the educational effects of the assessments used. Further research into the implementation of assessment literacy into the curriculum is required to understand the types of activities that will enhance learning and their impact on student performance.

7.5.4: The transition to veterinary practice

Educators should not underestimate the influence of the transition to practice on student learning. In addition they should appreciate that this is inevitably a stressful time for new graduates and therefore develop their curricula to prepare students for the challenges of employment. Strategies that will lead to greater preparation are likely to include increased case responsibility for students, more opportunity to practise clinical skills relevant to their future employment and further experience of case management with an emphasis on professional practice within the veterinary team. Further work is needed to develop a greater understanding of the requirements for practice within different species areas. This can then be used to inform future developments in veterinary curricula with the aim of enhancing preparation and employability within a chosen field. Finally, development of effective postgraduate training and

support strategies is required to ensure a continuum of veterinary education for all newly qualified veterinary surgeons.

7.6: Conclusion

At the start of each academic year, the staff at the SVMS are fortunate to welcome a group of deeply motivated students to the course. To assure their place at vet school, each student has demonstrated high academic achievement and a commitment to gaining relevant work experience whilst maintaining an appropriate balance of extra curricula activities. Their desire to become a veterinary surgeon and dedication to animal welfare has earned them their place at vet school. As educators, the learning outcomes we declare, the way in which we teach but most importantly the way in which we assess the students drives their learning behaviour. We have a responsibility to deliver a curriculum that allows a deep approach to the development of veterinary clinical competence and inspires students to reach their full potential. Currently not all assessments have a positive impact on learning and we must strive to continually improve our assessment strategy to achieve CA. Through a greater understanding of the transition to different areas of practice we can continue to refine our ILOs and develop our curriculum to meet the changing demands of the veterinary profession. CA provides a framework for curriculum development to ensure we provide the best possible education and that our students become the excellent veterinary surgeons they aspire to be.

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Appendices

Appendix 1: Concept note and ethical review

Research Projects Concept Note and Ethical Review

The 'Concept Note' should be completed for all research applications that are being developed. The 'Concept Note' should be submitted to the Research Directorate (chris.holland@nottingham.ac.uk) in the early stages of an applications development and prior to a full review being carried out by a member of the Research Directorate. An Ethical Review will be required for all applications. Please submit the completed form to Chris Holland for circulation to the Research Directorate and the Ethical Review Committee.

SVMS applicant name (indicate whether principal applicant or not): Kate Cobb

Project Title: PhD: Educational Impact of Assessment in a Veterinary Curriculum

Funding (awarding agency and amount sought): SVMS funded

Submission date: PhD start date 4/1/2011

Submission of concept note and ethical review 18/4/2011

Collaborators and Institutions involved: Supervisors: Richard Hammond, SVMS and Debbie Jaarsma, Faculty of Veterinary Medicine, Utrecht University, Jocelyn Habershon-Butcher, SVMS

A) Please provide a one page outline of the project with a statement of why the work is important (novelty and timeliness), hypotheses (if any), objectives, experimental plan and techniques to be used.

Introduction

The area of study for this research proposal is the predictive validity of

assessment tools used within the School of Veterinary Medicine and Science (SVMS) and their educational impact both within the undergraduate course and for members of the profession post graduation.

It is widely accepted that assessment is instrumental in driving student learning. A well performed, valid assessment tool not only informs the educator as to a student's progress, but will motivate the student to deepen their understanding of a subject. In contrast, student perception of assessments can result in a surface approach to learning based on short-term memory and recall of seemingly important facts. This type of assessment can mislead the student as to their progress or on-going learning needs in a professional and clinical context and is therefore a powerful and potentially dangerous tool. Due to the perceived importance of summative assessment, there is significant investment from both the School and the student in the assessment process each year. A greater understanding of how veterinary assessment tools can be utilised to have a positive effect on student learning would be helpful in gaining maximum benefit from the existing resource-intensive process.

Research questions:

1. Does the SVMS have an integrated program of assessment which is aligned with curriculum delivery?
2. What is the educational impact of assessments within SVMS and exactly how does assessment drive student learning?
3. Does assessment at SVMS affect lifelong learning and what impact does previous educational experience have on the future career of veterinary graduates?

Background

Assessment is an important component of any curriculum and traditionally assessment has been viewed by academics and students as a necessity to ensure the quality of a graduate (Pead, 2008). In a modern curriculum assessment should however serve many more purposes including: informing students of their weaknesses and ways in which they can improve; indicating to students the areas of the course which are important; motivating students; measuring the effectiveness of teaching and finally certification and progression (John A Dent, 2009).

Prior attainment has been used to predict the performance of medical students in their degree courses (Yates and James, 2006) and the predictive validity of undergraduate medical assessments to performance in medical practice was recently reported in a BEME systematic review (Hamdy et al., 2006). The recent concept of 'assessment for learning' (AFL) has lead to studies which have explored the positive effects of assessment on student learning and performance (Cilliers et al., 2010, Leung et al., 2008). However, there is a lack of information on the predictive validity or educational impact of assessments in veterinary education.

It is accepted that assessment drives learning but being able to identify how different types of assessment influence student learning would facilitate effective AFL design. The focus of assessment in many veterinary degree courses to date has been for progression and qualification purposes, however, if assessment is such a powerful tool we could use it more effectively to influence and facilitate the learning process. Not only within university but also for lifelong learning which is an essential component of professional practice.

Proposed methods include:

- Statistical correlations between attainment in assessments within the same strand, species areas, subjects and integrated modules
- Interviews and/or focus groups to collect more in depth data on the impact of assessment on an individual's learning and approach to study both pre and post graduation.
- The use of questionnaires both pre and post graduation to ascertain approach to learning, motivations, satisfaction and career choices and the influence of education, including assessment, on these areas.

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YATES, J. & JAMES, D. 2006. Predicting the "strugglers": case-control study of students at Nottingham University Medical School. *British Medical Journal,* 332**,** 1009-1012A.

B) Ethical information required:

For any clarification, please contact: richard.hammond@nottingham.ac.uk

1) Does this proposed project use animals or materials obtained from them? If yes go to Q2. If not go to Q9 ***NO***

2) Is the proposed project to be carried out as part of an existing project licensed under the Animal Scientific Procedures Act? If yes go to Q 3. If not go to Q4

3) Does the proposed project require any modification of the content described in the current project licence that would require a project variation and therefore review by the Site Ethics Committee?

Go to Q7

4) Does the study use samples, or part of samples, obtained from the animals using an invasive procedure? If no go to Q 7. If yes go to Q5

5) This study must fall under the Veterinary Surgeons Act. What is the source of the animals or animal derived material to be used in the proposed study?

Go to Q6

6) Informed owner consent must be obtained prior to obtaining these samples – even for cadaver material or surplus from samples taken as part of the clinical investigation. Has the process for obtaining such consent been discussed with the veterinary practice/animal keeper?

Go to Q8

7) Does the proposed project involve modification of the behavior or routine of the animal(s)? If so please describe these modifications and the potential impacts on the animal(s) then go to Q13. If No go to Q 13.

8) Describe in detail the process by which samples are to be obtained – site, amount concurrent medication (e.g. sedation), restraint, clipping of fur etc. Go to Q 7

9) Does the proposed study involve obtaining information by questionnaire or interview?

If yes go to Q10. If no go to Q11 ***Yes***

10) Have you read, understood and agree to abide with the Schools policy on data collection by questionnaire or interview? G:\School of Veterinary Medicine and Science\SVMS Information\Ethics.

If yes please go to Q13 ***Yes***

11) Does the proposed study involve obtaining 'owned' information through a third party – eg searching practice records about clinical cases?

If yes go to Q12 If no go to Q13 ***No***

12) Have you read and understood the relevant sections of the 1998 Data protection act

http://www.opsi.gov.uk/Acts/Acts1998/ukpga_19980029_en_1 as they relate to your proposed work, understand the implications of the act and agree that the proposed study does not infringe provisions of the act? Yes or No. ***Yes***

13) END – no further information required a this stage.

Signature of Research Directorate Reviewer: ……

Date:……

Signature of Ethical Review Committee Chairman: ……

Date:…….

Appendix 2: Initial attributes identified from the systematic review of the literature.

Group	Attribute
Practical/clinical skills	1. Surgical skills 2. Diagnostic imaging skills 3. Practical skills/Technical proficiency 4. Clinical skills eg centeses 5. Perform simple lab tests 6. Performing core clinical procedures 7. Anaesthesia skills 8. Clinical, radiographic and pathologic manifestations of disease 9. Surgical management procedures 10. Clinical examination skills 11. Animal handling skills/ responsible treatment of animals 12. Necropsy skills
Communication	1. Report writing and medical record keeping skills 2. Oral communication skills 3. Professional writing skills/ written communication skills 4. Presentation and public speaking skills 5. Empathy towards clients 6. Politeness 7. Good listening skills 8. Communication with colleagues 9. Communication with clients and the public/effective client relations/good at explaining technical terms 10. Eliciting a full patient history
Teamwork	1. Interpersonal and teamwork skills 2. Personnel management skills

	3. Conflict management skills 4. Friendliness 5. Negotiation skills 6. Leadership skills 7. Likeable personality 8. Respect for other veterinary healthcare professionals
Business and management	1. Business management skills 2. Organisational skills 3. Knowledge of veterinary practice management 4. Awareness of public concerns challenging business/industries future 5. Business acumen/ financial management 6. Decision making and client communication that contains the cost implications of treatment and care 7. Evaluation and appropriate utilization of complex and costly technology 8. Time management skills
Research	1. Research skills 2. Analytical skills 3. Observational skills 4. Search scientific literature 5. Evaluation of evidence/ appraise content and methodology of scientific literature 6. Retrieving, compiling and analyzing data 7. Ability to evaluate information/critically examine new information
Legislation and the profession	1. Knowledge of veterinary legislation/profession 2. Realistic view of the profession 3. Awareness of professional responsibilities to patients, clients, colleagues, society

	4. Involvement in public policy issues that impact the profession
Clinical knowledge	1. Veterinary clinical knowledge/ veterinary medicine and surgery 2. Competencies in animal reproduction and neonatal care 3. Manifestation of disease in individuals/populations 4. Disease aetiologies 5. Correlations of altered pathophysiology with disease/etiology and pathophysiology 6. Disease transmission and pathogenicity 7. Toxicology 8. Knowledge of disease 9. Risk factors for disease 10. Population health and epidemiology 11. Testing for animals at risk or in early stages of disease 12. Foundation principles of animal wellness and health maintenance 13. Principles of diagnosis, medical management and treatment 14. Medications and pharmaceuticals 15. Response to injury, stress and disease 16. Alternative therapy
Basic science knowledge	1. Knowledge of underpinning science/ provide a solid base of scientific information 2. Normal structure and function of the body/ microscopic and macroscopic morphology 3. Molecular, biochemical and cellular mechanisms 4. Comprehension of disease from the molecular to the population level 5. Appropriate nutrition and patterns of eating 6. Immunization/ immunology 7. Reproduction and animal husbandry 8. Normal growth patterns

	9. Chemical products 10. Therapeutic products 11. Normal behaviour and behavioural responses
Veterinary public health	1. Knowledge of VPH/zoonotic issues 2. Diagnosis, treatment and prevention of zoonotic diseases 3. Knowledge of the roles and uses of animals with good awareness of the diversity of client perspectives
Working under pressure	1. Ability to cope with pressure/stress 2. Ability to handle difficult situations 3. Tolerance of conflicting ideas 4. Dealing with emergency/critical care cases
Limitations and seeking advice	1. Recognising own limitations and when to seek advice/identifying strengths 2. Consult colleagues and refer cases when indicated 3. Capacity for self audit 4. Ability to function independently of supervision
Personal development	1. Commitment to CPD and LLL/remain current with emerging knowledge and incorporate new knowledge and methods into practice 2. Self motivation to do the best job possible 3. Enthusiasm for learning/ positive work attitude 4. Career options
Personal attributes	1. Confidence 2. Integrity/honesty 3. Patience 4. Decisiveness

	5. Maturity 6. Initiative and self motivation 7. Attention to detail 8. Neatness in work area 9. Cleanliness
Problem solving	1. Problem solving and critical thinking 2. Decision making 3. Thinking creatively and independently
Coping with change	1. Flexibility in adapting to new situations 2. Ability to cope with uncertainty 3. Being an advocate for change
IT skills	1. IT literacy 2. Numeracy skills
Making a diagnosis	1. Correctly diagnosing and treating common health problems 2. Diagnostic reasoning abilities 3. Diagnosis and treatment of disease 4. Clinical reasoning – finding and using medical knowledge 5. Formulating and ranking a list of differential diagnoses 6. Selection and interpretation of ancillary diagnostic tests
Case management and therapeutics	1. Advise on and administer appropriate treatment/develop clinical management and therapeutic strategies 2. Monitor patient progress and adjust therapy 3. Make a prognosis
Preventative	1. Promoting/providing health maintenance services 2. Fostering wellness and encouraging preventative care

healthcare	3. Competency in disease and trauma prevention/ give advice on disease prevention 4. Promote well being and health maintenance
Euthanasia	1. Dealing with animal death and euthanasia/ recognition for need and implementation of euthanasia
Professionalism	1. Ethical awareness/ veterinary medical ethics/ethical judgement 2. Professional appearance 3. Ability to balance personal and professional responsibilities 4. Community involvement/responsibility
Compassion	1. Placing patient benefits above one's own interests 2. Recognition and relief of pain and suffering 3. Understanding of the nature of the human animal bond and contributions animals can make to human health 4. Compassion/for animals

Appendix 3: Letter of consent for participation in the staff focus group

Thank you very much for volunteering to participate in this focus group. The aim of the group is to produce a list of 'learning outcomes' or 'attributes' which you feel are important for Nottingham veterinary graduates to have achieved.

The outcomes generated today will be used to produce an outcomes assessment survey that will be sent to all recent graduates. The purpose of outcomes assessment is to evaluate the current curriculum and how aligned it is with the goal of producing competent new graduate veterinary surgeons. We hope to identify strengths as well as any deficits within the curriculum in order that we can continually improve the educational experience for all students.

This focus group is part of a PhD study; however we aim to incorporate the process into annual course evaluation that is likely to be required for accreditation purposes in the future.

Several studies have been carried out to determine the desired attributes of veterinary graduates and requirements for practice. Delivering a novel curriculum, it is important to determine whether these attributes are similar for Nottingham graduates and are there other outcomes unique to our course that should be included in the evaluation.

The discussion during this focus group will remain confidential and participant's names will not be revealed at any stage during the research. This study has been approved by the SVMS ethical review panel and I guarantee that good ethical conduct will be observed throughout as outlined in the 'Revised Ethical Guidelines for Educational Research (2011)' by the British Educational Research Association (BERA). If you have any questions please don't hesitate to contact me directly at katy.cobb@nottingham.ac.uk or on 0115 9516477.

I would be grateful if you would sign below to show that you agree to participate in the focus group.

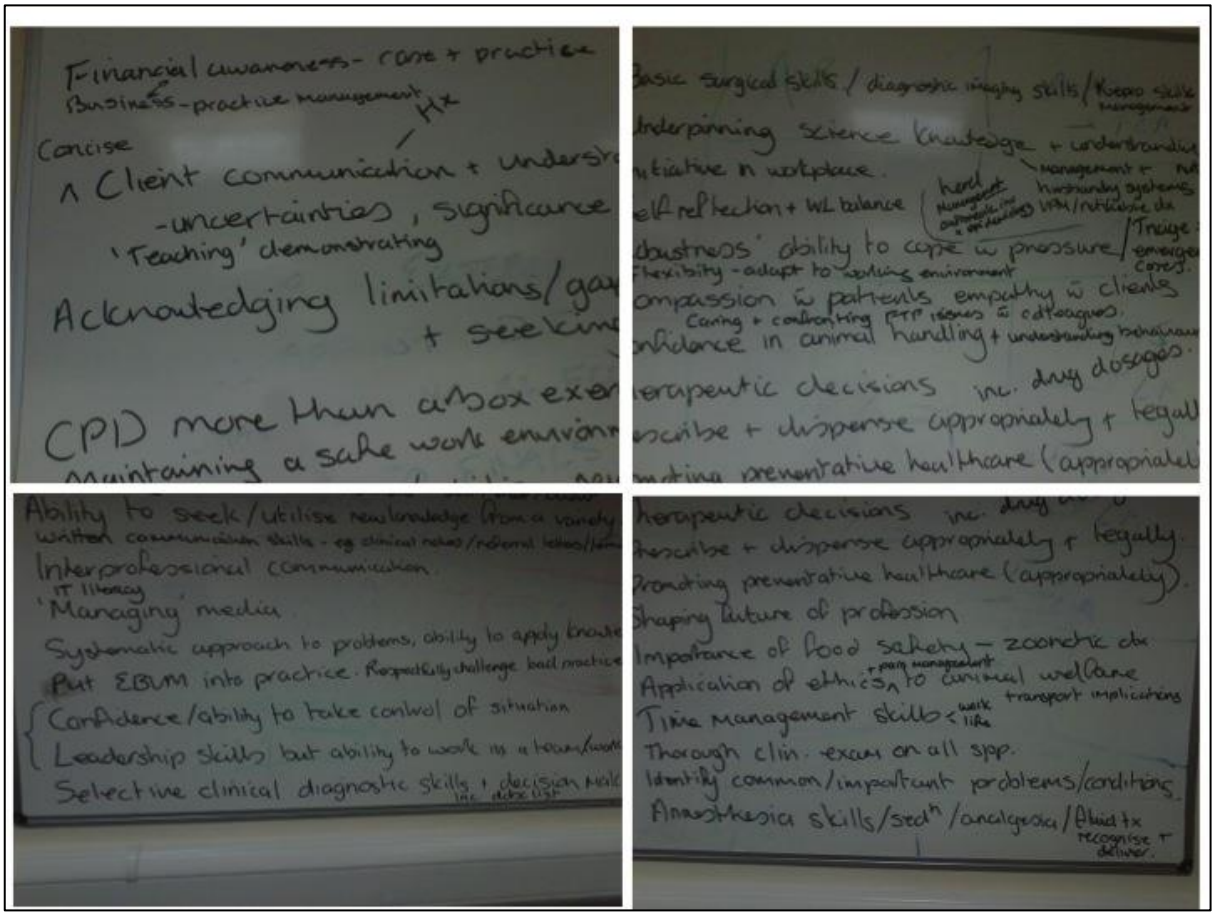
Signed:

Print Name:

Please retain one signed copy for your files.

Appendix 4: Outputs from the SVMS staff focus group

a. Evidence from the whiteboard. Due to the size of the board and volume of information, this was photographed in sections to enable the content to be read.



b. The list of attributes produced as a result of the focus group.

Focus group attributes:

1. Financial awareness in case management
2. Understanding of financial and business aspects of practice management
3. Concise client communication including history taking and giving information at the appropriate level

4. Understanding client needs and maintaining respect for all clients
5. Acknowledging clients' uncertainties and explaining significant factors and appropriate next steps within a case
6. Awareness of current legislation including issues such as transportation and organic farming schemes
7. Acknowledging own limitations and gaps in knowledge, being open to constructive criticism and seeking help where needed
8. Self-improvement and engagement in CPD so it is not viewed as just a tick box exercise
9. Maintaining a safe working environment for self, other staff and clients
10. Ability to seek and utilize new knowledge from a variety of sources
11. Written communication skills for example clinical records and referral letters using appropriate terminology
12. Interprofessional communication and communication with veterinary colleagues
13. IT literacy
14. Managing and communicating with the media
15. Systematic approach to problems ability to apply knowledge
16. Putting EBVM into practice and respectfully challenging bad practice
17. Confidence and ability to take control of a situation
18. Leadership skills with the ability to work in a team
19. Selective clinical diagnostic skills and decision making including compiling an appropriate differential diagnosis list
20. Basic surgical skills
21. Diagnostic imaging skills

22. Reproductive management
23. Underpinning scientific knowledge and understanding
24. Knowledge of animal management and husbandry systems including nutrition
25. Herd management and epidemiology
26. VPH and notifiable disease
27. Showing initiative in the workplace
28. Self reflection and maintaining a work life balance
29. Robustness and ability to cope with pressure
30. Triage and dealing with emergency cases
31. Flexibility and able to adapt to the working environment
32. Compassion with patients and empathy with clients
33. Caring and confronting FTP issues with colleagues
34. Confidence in animal handling and understanding animal behaviour
35. Making therapeutic decisions
36. Prescribe and dispense appropriately and legally including drug dose calculations
37. Appropriate promotion of preventative healthcare
38. Shaping the future of the profession including issues which are realistic and will make a difference and understanding those issues which are not
39. Importance of food safety and knowledge of zoonotic diseases
40. Application of ethics to pain management and animal welfare including transportation
41. Time management skills within work and personal life
42. Perform a thorough clinical exam on all spp

43. Identify common and important problems and conditions
44. Anaesthesia skills and appropriate administration of sedation, analgesia and fluid therapy

Appendix 5: Letter sent out to all graduates on behalf of Professor Gary England requesting their participation in the graduate survey.

Dear

As part of our ongoing course evaluation and improvement, we would like to know how your experience at Nottingham Vet School has prepared you for your career and invite you to participate in the graduate survey.

Please can I ask you to take the time to provide your opinions on the education you received at Nottingham and return the completed survey in the envelope provided (no stamp required). The survey will take less than 10 minutes to complete; the first two sections ask you to rate how well the course and the assessment system at Nottingham prepared you for your current job. In the final section you are asked to provide some general information about your current role.

Alternatively you can complete the survey online at the following address:

http://www.surveymonkey.com/s/TQLSCGC

Please complete all sections of the survey where possible. The data collected will be anonymised and used for course evaluation and educational research. This study has been approved by the School of Veterinary Medicine and Science's ethics committee. Participation is entirely voluntary and by completing the survey you are consenting to take part.

If you would like any further information on the graduate survey please contact Kate Cobb on 0115 9516477 or email at Katy.Cobb@nottingham.ac.uk or Liz Mossop at Liz.Mossop@nottingham.ac.uk

By completing the graduate survey you are contributing to the continual improvement of the veterinary course at Nottingham, and therefore your opinions are valuable to us.

Yours sincerely,

Gary England

Appendix 6: The Graduate Survey

Graduate Survey

Section 1: The veterinary course at Nottingham

Please try to consider the education you received whilst at Nottingham Vet School when answering the questions rather than any support or CPD you have received post graduation. Please use the free text boxes to enter any additional comments within each area.
Thinking about the demands of your current role, use the following options to tell us how prepared you feel for your job in each area:

Excellent preparation: I am able to carry out all requirements of my current job

Good preparation: I have needed minimal support or training since graduation

Adequate preparation: I felt somewhat prepared although have needed to utilise support and training since graduation

Poor preparation: insufficient coverage of this area in the course to be adequately prepared, significant support and training post-graduation have been necessary

Not at all prepared: the course did not prepare me at all to carry out the requirements of my current job in this area, further support and training have been essential

1. Knowledge of underpinning basic science at a level appropriate for your current role. (Including normal structure and function of healthy animals; molecular, biochemical and cellular mechanisms; mechanisms of defence; animal management, nutrition and husbandry systems)

◯	◯	◯	◯	◯
Excellent	Good	Adequate	Poor	Not at all

Comments

2. Veterinary Clinical Knowledge at a level appropriate for your current role.
(Including disease aetiology and pathophysiology; mechanisms of disease transmission; knowledge of medical and surgical management)

◯	◯	◯	◯	◯
Excellent	Good	Adequate	Poor	Not at all

Comments

3. Clinical and surgical skills
(Including diagnostic imaging skills; basic surgical skills; anaesthesia skills and fluid therapy)

◯	◯	◯	◯	◯
Excellent	Good	Adequate	Poor	Not at all

Comments

4. Clinical examination skills
(Within all species and including animal handling and an understanding of animal behaviour)

◯	◯	◯	◯	◯
Excellent	Good	Adequate	Poor	Not at all

Comments

5. Diagnostic reasoning abilities
(Including compiling an appropriate differential diagnosis list; decision making and identification of common and important conditions)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

6. Clinical case management and therapeutic strategies
(Including making therapeutic decisions; prescribing and dispensing appropriately and legally; performing drug dose calculations and reproductive management)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

7. Dealing with emergency and critical care cases
(Including initial assessment and triage of emergency cases)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

8. Promoting preventative healthcare

Excellent | Good | Adequate | Poor | Not at all

Comments

9. Population health and epidemiology

Excellent | Good | Adequate | Poor | Not at all

Comments

10. Dealing with veterinary public health and zoonotic issues (Including notifiable diseases and an understanding of the importance of food safety)

Excellent | Good | Adequate | Poor | Not at all

Comments

11. Recognition for need and implementation of euthanasia

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

12. Veterinary practice and financial management
(Including financial awareness in case management)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

13. Recognising own limitations and seeking help and advice where needed
(Including reflective practice and being open to constructive criticism)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

14. Ability to seek, critically evaluate and utilise new information from a variety of sources

Excellent | Good | Adequate | Poor | Not at all

Comments

15. Knowledge of current veterinary legislation

Excellent | Good | Adequate | Poor | Not at all

Comments

16. Compassion for animals and the application of ethics to animal welfare

Excellent | Good | Adequate | Poor | Not at all

Comments

17. Awareness of professional responsibilities to patients, clients, colleagues, society (Including understanding the needs and maintaining respect for all clients; engagement in CPD and life long learning; putting EBVM into practice and respectfully challenging bad practice; maintaining a safe working environment; showing a caring attitude towards colleagues and shaping the future of the profession)

◯	◯	◯	◯	◯
Excellent	Good	Adequate	Poor	Not at all

Comments

17. Communication skills
(Including empathy and communication with clients; written communication skills for example clinical records and referral letters; communication with veterinary colleagues and paraprofessionals)

◯	◯	◯	◯	◯
Excellent	Good	Adequate	Poor	Not at all

Comments

19. Interpersonal and teamwork skills

(Including Leadership skills; showing initiative in the workplace; time management skills and confidence to take control of a situation)

Excellent	Good	Adequate	Poor	Not at all
○	○	○	○	○

Comments

20. 'Robustness' – the ability to manage pressure and stress

Excellent	Good	Adequate	Poor	Not at all
○	○	○	○	○

Comments

21. Flexibility and ability to cope with change

Excellent	Good	Adequate	Poor	Not at all
○	○	○	○	○

Comments

22. Self-reflection and maintaining a work life balance

Excellent | Good | Adequate | Poor | Not at all

Comments

23. Systematic approach to problem solving and critical thinking

Excellent | Good | Adequate | Poor | Not at all

Comments

24. IT skills required for your current role

Excellent | Good | Adequate | Poor | Not at all

Comments

25. Research skills

Excellent | Good | Adequate | Poor | Not at all

Comments

26. Overall competence to do the job for which you were hired

Excellent | Good | Adequate | Poor | Not at all

Comments

Graduate Survey

Section 2: How you were assessed

Please tell us your views on the methods of assessment at Nottingham. Consider the way in which you prepared, the experience of sitting the assessment and the feedback you received for each of the following assessments and rate how useful it was in preparation for your career by selecting one of the following options:

Excellent preparation: very relevant to my current role

Good preparation: relevant to my current role

Adequate preparation: somewhat relevant to my current role

Poor preparation: little relevance to my current role

Not at all prepared: not relevant to my current role

1. Online multiple choice questions
(Including extended matching, assertion-reason and diagrammatic questions)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

2. DOPS
(Directly observed procedural skills performed on clinical rotations)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

3. SCT
(Script concordance test, completed online at the end of final year)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

4. OSCEs/OSPEs
(Objective structured clinical/practical examinations sat in 1st, 2nd and 3rd year)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

5. Clinical reasoning exam
(Written case based exam sat in 4th year)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

6. Portfolio including final year portfolio viva

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

7. Spot tests
(Rotating around several stations usually within the dissection room)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

8. Animal Health and Welfare presentation

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

9. PPS coursework
(Coursework for the personal and professional skills module in years 1, 2, 3 and 4)

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

10. 3rd year research project

Excellent	Good	Adequate	Poor	Not at all
◯	◯	◯	◯	◯

Comments

Please use the space below to add any additional comments on the way in which your knowledge and skills were assessed at Nottingham

Graduate Survey

Section 3: General Information

1. Has your experience of work since graduation matched up to your expectations?

◯ Yes

◯ No

If not please explain why:

2. Did the contents of the program affect your eventual choice of work?

- ◯ Yes
- ◯ No

3. If you could repeat your time at university would you still study veterinary science at Nottingham?

- ◯ Yes
- ◯ No

4. In which type of practice are you currently employed?

- ◯ Small
- ◯ Farm
- ◯ Equine
- ◯ Exotic
- ◯ Mixed: please state % work with each species in the space below
- ◯ Other, if you are not currently in clinical practice please describe your employment in the space below

◯ Not currently employed

Please state the proportion of time spent with each species if in mixed practice or describe your role if you are not currently employed in practice:

5. Please state the length of time you have been employed in your current job:

6. Please state your name, this will not be used with any of the information you have provided in this survey. Your responses will be kept anonymously.

Thank you for completing the Nottingham Graduate Survey.

Appendix 7: The shortened SPQ

The study process questionnaire has been widely used to assess students' approaches to learning. There are no correct responses, it depends what suits your own style and university course.

The questionnaire has a number of statements about your attitudes towards your studies and your usual way of studying during rotations and in preparation for finals examinations.

If you think that an answer would depend on the subject being studied, give the answer based on the discipline/species area most important to you.

Please select the most appropriate letter for each statement. Each letter represents the following responses:

A: this item is ***never or only rarely*** true of me
B: this item is ***sometimes*** true of me
C: this item is true of me ***about half of the time***
D: this item is ***frequently*** true of me
E: this item is ***always or almost always*** true of me

Please chose the ***one*** most appropriate response to each statement firstly when considering studying during rotations and secondly when preparing for the finals examination.

Select the response that best fits your immediate reaction; do not spend a long time on each item.
All responses are confidential, so please answer honestly.

1) While I am studying, I often think of clinical situations to which the material that I am learning would be useful.

	A	B	C	D	E
During rotations					

Exam preparation

2) I chose to study veterinary medicine largely with a view to the job situation when I graduate rather than the intrinsic interest to me.

A B C D E

During rotations

Exam preparation

3) I find that at times studying gives me a feeling of deep personal satisfaction.

A B C D E

During rotations

Exam preparation

4) I want top grades in most or all of my modules so that I will be able to select from among the best positions available when I graduate.

A B C D E

During rotations

Exam preparation

5) I think reading around is a waste of time, so I only study seriously what's covered in rotations or in module learning objectives.

A B C D E

During rotations

Exam preparation

6) I try to work consistently throughout the term and review regularly when assessments are close.

A B C D E

During rotations

Exam preparation

7) I would see myself basically as an ambitious person and want to get to the top, whatever I do.

A B C D E

During rotations

Exam preparation

8) I find that I have to do enough work on a topic so that I form my own point of view before I am satisfied.

A B C D E

During rotations

Exam preparation

9) I summarise suggested readings and include these as part of my notes on a topic.

A B C D E

During rotations

Exam preparation

10) I find that virtually any topic can be interesting and exciting once I get into it.

A B C D E

During rotations

Exam preparation

11) I usually become increasingly absorbed in my work the more I do.

A B C D E

During rotations

Exam preparation

12) I learn some things by rote going over and over them until I know them by heart even if I do not understand them.

A B C D E

During rotations

Exam preparation

13) I almost resent having to do further years studying after leaving school, but feel that the end results make it all worthwhile.

A B C D E

During rotations

Exam preparation

14) I see getting high marks as a kind of competitive game, and I play it to win.

A B C D E

During rotations

Exam preparation

15) I find it best to accept the statements and ideas of lecturers and clinicians and question them only under special circumstances.

A B C D E

During rotations

Exam preparation

16) Whether I like it or not, I can see that further education is for me a good way to get a well-paid or secure job.

A B C D E

During rotations

Exam preparation

17) I try to relate new material, as I am reading it, to what I already know on the topic.

A B C D E

During rotations

Exam preparation

18) I keep neat, well organised notes for most subjects.

A B C D E

During rotations

Exam preparation

Please add any additional comments you wish to include regarding studying during rotations:

Please add any additional comments you wish to include regarding preparation for end of year exams:

Appendix 8: Questions used for as a framework for discussion of DOPS and MCQs in student interviews

General perception

1) How do you feel about assessment generally at SVMS?
2) How have your feelings towards assessment changed over the 5 years within SVMS?
3) What do you think the main purpose of assessment is?
4) Do you think the purpose changes from years 1-5?
5) Do you perceive the assessment system to be fair at the SVMS?

Learning

1) How has assessment influenced the way you approach study during final year?
2) How has your approach differed for the MCQs in finals compared to DOPS on rotations?
3) Do you see assessment as a positive element of the course in facilitating learning?
4) How do you perceive formative assessment?
5) What are your thoughts on the feedback you have received at SVMS?

Assessment formats

1) What are your thoughts on
    a. Practical skills assessment at SVMS?
    b. Assessment of knowledge?
    c. Clinical reasoning skills?
    d. Professionalism
2) Which of these formats do you think will be beneficial to your future career?

Future career

1) What do you understand by the term LLL and how important is it to you?
2) How will you continue to learn in practice?
3) How will this approach differ to your learning within SVMS?
4) How motivated do you feel at the moment to continue to learn within your career?

Do you have any further questions?

Appendix 9: Email sent to final year students requesting participants for the SCT study

To all final year students,

As part of a study looking at the script concordance test (SCT) I am looking for volunteers to trial some questions and then talk about the SCT question format.

Participants will have access to 3 formative SCT papers during the year, which will be completed online and should take about 30minutes each. Volunteers will be expected to attend a focus group where you will be asked to share your opinions on the format.

By volunteering to participate in this study you will receive additional formative SCT practise questions. You will receive a mark for each paper and also be able to see the comments from the practitioners on the reference panel. This information is for your own feedback; your mark will remain confidential and will not affect either your rotational assessment or your end of year assessment.

Focus groups will be arranged for a convenient time and location, depending on your rotation timetable.

Should you wish to volunteer to participate in this study, please reply to this email by **Friday 15th June**.

Many Thanks,

Kate

Appendix 10: Email to participants of the SCT study

Thank you very much for agreeing to take part in the Script Concordance Test Study. You should now be able to access the 1st of 3 SCT papers by clinking on the link at the end of this email. The paper will be available to access for 2 weeks until 25th July.

Please note that these are purely formative assessments and will have no impact on your final year exams or on your rotation assessments. Your score for each assessment will remain confidential.

There are 20 questions in the test, you should read through the attached information and example SCT question before you begin.

When you have completed the test click 'finish' and this will take you to your feedback screen. For each question you will see the most popular answer in **bold**, comments from the panel on each selected option are provided as feedback in *red italics*. You will be given your score for each question, a half mark tells you that you have selected a correct answer but not the most popular answer from the panel. At the end of the screen your total score is provided.

As part of the study you are requested to attend a focus group where you will be asked to share your opinions on the format. Please could you confirm your attendance by reply to this email and selecting a convenient focus group time from the following options:

Wednesday 25th July, 7pm

Monday 30th July, 7pm

Monday 6th August 6pm

All focus groups will be held at the SVMS and refreshments will be provided. If you are unable to attend one of the above dates please contact me to make alternative arrangements.

If you have any problems accessing the assessment from the following link please contact Kay Millward:

https://rogo/user_index.php?id=5327134157775812653

Many thanks,

Kate

Appendix 11: Instructions provided to participants in the SCT study prior to completion of the assessments.

The Script Concordance Test (SCT) has been used to assess clinical reasoning skills in real-life situations that are often ambiguous. For this reason there is no single correct answer, unlike the online exam questions you have previously been assessed on. Your score for the SCT will depend on the degree to which you agree with the opinions of a panel of practising veterinary surgeons.

The SCT questions are based around 3 areas of clinical decision-making:

- Making a diagnosis
- Selecting an appropriate diagnostic test
- Selecting a treatment or appropriate intervention

You will be asked to consider a case description, followed by some further information. You will then be asked to judge how that new information affects the diagnosis, an investigation or treatment for that case.

Each question should be considered as a separate item. Several questions may be based on the same case but the questions are not related, only consider the information provided for that question.

The following example shows how you should approach SCT questions (Adapted from the SCT examples from the 2006 ViEW workshop, Genoa)

1. First read the case descriptio

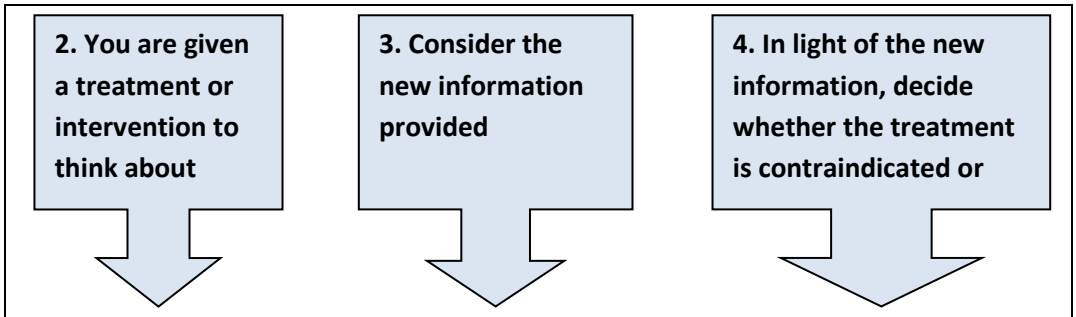
For the second time this month you are called out to a 9 year old mare with recurring colic. At the first consultation you suspected the cause to be impaction of the left ventral colon, which was treated with analgesics and mineral oil. After 2 days the constipation appeared to resolve; nevertheless the horse continued to have clinical signs of mild diarrhoea and a reduced appetite. Since yesterday the horse has clinical signs of colic again.

During your examination you find some abdominal distension and you hear spontaneous gut sounds. Rectal examination reveals no abnormalities. The horse is restless and sweating, pulse rate is 52 bpm and rectal temperature is 38.2^{o}C. There is yellow discolouration of the conjunctiva and sclera and she has a poor coat.

2. You are given a diagnosis to think about	**3. Consider the new information you are given**	**4. Decide whether the new information makes the diagnosis more or less likely**
Suppose the differential diagnosis you consider is: a severe infection with cestodes	**And further investigation shows:** no parasitic infection can be determined from faecal examination	**Then this hypothesis becomes:** • Very unlikely • Unlikely • Neither likely or unlikely • More likely • Very likely

1. You will be given the case information again. Questions are NOT related so ignore any additional information previously given.

2. You are given a diagnostic test to think about	**3. Consider the new information you are given**	**4. Decide whether the new information makes the test more or less useful**
Suppose you consider the following further investigation: paracentesis	**And you discover that:** the colic increases during riding	**Then this investigation is:** • Useless • Less useful • Neither more or less useful • More useful • Very useful



Suppose you are considering the following intervention: analgesic treatment and referral	**And further clinical examination reveals:** there are hooks on several molars/cheek teeth	**Then this intervention becomes:** • Contraindicated • Less indicated • Neither more or less indicated • Indicated • Strongly indicated

Appendix 12: Letter to students requesting their consent to participate in the SCT focus group discussions

Dear

Thank you very much for volunteering to participate in a focus group/interview which is part of a study aiming to investigate the educational impact of assessment on the students' experience at the SVMS. The focus for the discussion will be the script concordance test.

The focus groups/interviews are strictly confidential, will be used for educational research only and participant's names will not be revealed at any stage.

This study has been approved by the SVMS ethical review panel and I guarantee that good ethical conduct will be observed throughout as outlined in the 'Revised Ethical Guidelines for Educational Research (2011)' by the British Educational Research Association (BERA).

You have the right to withdraw at any time. If you have any questions please don't hesitate to contact me directly at katy.cobb@nottingham.ac.uk or on 0115 9516477.

I would be grateful if you would sign below to show that you have read these conditions and agree to participate in the study.

Please retain one signed copy for your files.

Yours sincerely,

Kate Cobb

I, _____, agree to take part in this educational research project.

Signature: _____

Date: _____

Appendix 13: Questions for the SCT focus group discussion

First impressions:

1. What are your initial thoughts on the SCT?
2. How did you feel about the content of the test?

Cognitive approach to SCT:

3. Do you think the SCT assesses anything different to the regular MCQs?
4. When answering SCT does it make you think any different from the regular MCQs?
    a. Do you draw on different knowledge/experience to answer SCT compared to regular MCQ questions?

Study techniques:

5. Did you complete this on your own or collaboratively? Why?
6. Did you use any resources? Why? Which?
7. Did you discuss the test afterwards
8. Did you read up on any topics afterwards
9. How would you prepare for a summative SCT
10. Would it alter the way you approach/think about CEMS or IMR?

Purpose:

11. Do you think it helps develop clinical reasoning skills?
12. How do you think it would be most helpful to your learning/development as a practitioner?
13. What were your thoughts about the feedback screen?

Appendix 14: Email requesting responses to the SCT survey

Many thanks for your participation so far in the SCT study. You should now be able to access the 3rd and final SCT paper by clicking on the link at the end of this email. The paper will be available to access until 10th June 2013.

Please remember that this is purely formative assessment and will have no impact on your final year exams or on your rotation assessments. Your score for each SCT assessment will remain confidential. There are 24 questions in this test, all questions related to a case are on the same screen. I have attached the SCT information and example question should you wish to remind yourself of the format.

When you have completed the test click 'finish' and this will take you to your feedback screen. For each question you will see the most popular answer in **bold**, comments from the panel on each selected option are provided as feedback in *red italics*. You will be given your score for each question, a half mark tells you that you have selected a correct answer but not the most popular answer from the panel. At the end of the screen your total score is provided.

As part of the study you are requested to provide feedback and share your opinions on the format. I understand that it is difficult for many of you to attend a focus group and so would ask that you complete the survey at the link below:

http://www.surveymonkey.com/s/TQ6SJN2

Please use the free text boxes for any additional comments you may have on the format, your opinions are very valuable to us and all responses will remain anonymous. The survey should take less than 10 minutes to complete and I would appreciate it if all participants could complete it, including people who have previously attended a focus group.

If you have any problems accessing the assessment from the following link please contact Kay Millward:

https://rogo/user_index.php?id=6777136299654112653

Many thanks,

Kate

Appendix 15: The SCT student questionnaire

Script Concordance Test Survey

1: The SCT format

Thank you for taking the time to complete this survey, your responses will be anonymised and treated confidentially. Please complete all 15 questions and use the free text boxes for any additional comments.

Your opinions are important and valuable to us.

1. Please select which of the following you have completed or participated in, tick all which apply to you:

- ◯ SCT study papers
- ◯ SCT study focus groups
- ◯ Year 5 formative SCT

Please add any comments regarding participation in this study:

2. Please rate on a scale of 1 – 6 how easy the SCT format was to complete, where 1 is very simple to understand and 6 is confusing

Very easy to understand	Easy to understand	Somewhat easy to understand	Somewhat difficult to understand	Difficult to understand	Confusing
◯	◯	◯	◯	◯	◯

3. How useful do you find the following sources of information when answering the SCT?

	Not at all useful	Of little use	Somewhat useful	Very useful
Lecture notes	◯	◯	◯	◯
Textbooks	◯	◯	◯	◯
Internet search	◯	◯	◯	◯
Clinical experience	◯	◯	◯	◯

Please add any further comments on how you have approached the SCT questions and any resources you have used:

4. When answering exam questions, you may rely on facts that you have learnt, alternatively you may need to think and apply your knowledge to answer a question.

For each of the following formats indicate, on a scale of 1 – 6, which method you rely on, where 1 = pure factual recall and 6 = maximum use and application of knowledge, including interpretation of information and synthesizing new ideas.

	Only recall of information	Majority recall	More recall than use of knowledge	More use of knowledge than recall	Majority use of knowledge	Maximum use of knowledge
MCQs	◯	◯	◯	◯	◯	◯
Clinical reasoning cases (sat in 4th year)	◯	◯	◯	◯	◯	◯
DOPS	◯	◯	◯	◯	◯	◯
SCT	◯	◯	◯	◯	◯	◯

Please add any other comments about how you answer the different formats:

5. On a scale of 1 – 6, where 1 = very unfair and 6 = a very fair test of you clinical ability, how would you rate the following exam formats?

	Very unfair	Unfair	Somewhat unfair	Somewhat fair	Fair	Very fair
MCQs	◯	◯	◯	◯	◯	◯
Clinical reasoning cases (sat in 4th year)	◯	◯	◯	◯	◯	◯
DOPS	◯	◯	◯	◯	◯	◯
SCT	◯	◯	◯	◯	◯	◯

Please use this space to explain your answers:

6. Will you prepare differently for the SCT paper compared to the MCQ in the finals exam?

Yes ◯

No ◯

Please explain your answer:

7. How often do you discuss exam questions? For each of the following question types state how often you would discuss them on a scale of 1 – 6, where 1 = never and 6 = always promotes discussion with vets and other vet students.

	Never discuss	Occasionally discuss	Sometimes discuss	Often discuss	Frequently discuss	Always discuss
MCQs	◯	◯	◯	◯	◯	◯
Clinical reasoning cases (sat in 4th year)	◯	◯	◯	◯	◯	◯
DOPS	◯	◯	◯	◯	◯	◯
SCT	◯	◯	◯	◯	◯	◯

Please add any additional comments about how and why you might discuss exam questions with vets and other students:

8. Do different exam questions alter your approach to clinical rotations or CEMS? For each of the following question types state the extent to which your approach would be influenced, on a scale of 1 – 6, where 1 = no influence and 6 = greatly influences your approach to CEMS or rotations.

	Would not influence my approach	Negligible influence	Small influence	Moderate influence	Considerable influence	Greatly influences my approach
MCQs	◯	◯	◯	◯	◯	◯
Clinical reasoning cases (sat in 4th year)	◯	◯	◯	◯	◯	◯
DOPS	◯	◯	◯	◯	◯	◯
SCT	◯	◯	◯	◯	◯	◯

Please use this space to explain your answer:

9. To what extent do exam questions encourage you to read around a case or topic? For each of the following question types state the how often you read around the subject, on a scale of 1 – 6, where 1 = never and 6 = always read up on the case or topic in the question.

	Never	Occasionally	Sometimes	Often	Most of the time	Always read around the subject
MCQs	◯	◯	◯	◯	◯	◯
Clinical reasoning cases (sat in 4th year)	◯	◯	◯	◯	◯	◯
DOPS	◯	◯	◯	◯	◯	◯
SCT	◯	◯	◯	◯	◯	◯

Please use this space to explain your answer:

2: Clinical Reasoning

Clinical reasoning can be defined as the process by which practitioners make decisions around patient evaluation and management in a specific clinical context.

To what extent do you agree with the following statements about the SCT and clinical reasoning?

10. The SCT format helps me to DEVELOP my clinical reasoning skills

Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
○	○	○	○	○	○

11. The SCT format is a good way to TEST my clinical reasoning skills

Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
○	○	○	○	○	○

12. Thinking about the feedback screen at the end of each SCT paper, to what extent do you agree with the following statement:

The explanations from the vets on the feedback screen help to develop my clinical reasoning skills.

Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
○	○	○	○	○	○

Please add any additional comments about the feedback received on the SCT papers:

Thank you for completing the SCT survey

Appendix 16: The transition to practice: employer survey

Employer Survey

The transition from vet student to veterinary surgeon

Thankyou for taking the time to complete this questionnaire. The aim of the study is to identify factors which employers consider to be important in making the transition from vet student to veterinary surgeon and what attributes employers look for when recruiting new graduate vets.

1. Do you currently employ or have you in the past employed a new graduate veterinary surgeon? For the purposes of this survey, please consider anyone in their first year of practice as a new graduate veterinary surgeon.

- ◯ Yes, currently employ a new graduate
- ◯ Yes, have previously employed a new graduate
- ◯ No, have never employed a new graduate

2. What factors do you consider to be important for new graduates to make a successful transition from student to practising veterinary surgeon?

3. Do you think that a UK veterinary degree is adequate preparation for a career in veterinary practice?

- ◯ Yes

◯ No

Please explain your answer, in particular please identify any areas which you feel are lacking from UK veterinary degree courses:

4. Does your practice have a programme of support in place for new graduate veterinary surgeons?

◯ Yes

◯ No

Please give details of any support structures provided:

Recruiting a new graduate veterinary surgeon

5. What do you look for when recruiting a new graduate veterinary surgeon?

6. Are any of the following academic criteria important to you in recruiting a new graduate veterinary surgeon? Please tick all that are important to you:

- ◯ Degree classification awarded
- ◯ Being within the top 10% of their year
- ◯ The university at which they studied

Please use this space to explain your answer:

7. Which of the following influence your decision to employ a new graduate veterinary surgeon? Please tick all that are important to you:

- ◯ The applicants CV
- ◯ The references provided
- ◯ Previous clinical experience

◯ Hobbies and non-veterinary related work experience

Please use this space to explain your answer:

8. Do you assess any of the following attributes when interviewing a new graduate veterinary surgeon? Please tick all that apply:

◯ Veterinary knowledge

◯ Clinical competence

◯ Interpersonal skills

Please use this space below to explain any assessments you use in your interviews:

Your practice

9. What type of practice do you work in? Tick all which apply:

◯ Small animal

◯ Equine

◯ Farm animal

◯ Exotics

◯ Mixed

If you work in mixed practice please state the % work with each species:

10. Which of the following best describes the caseload within your practice?

◯ First opinion only

◯ First opinion and referral cases

◯ Referral cases only

11. Do you or any of the vets working at your practice hold a postgraduate qualification?

◯ Yes

◯ No

If yes, please give details of the qualification(s)

Thank you for completing the employer survey

Appendix 17: Email to employers

Dear Employer,

As part of my PhD I am looking for employers of new graduates to complete a short questionnaire on the transition from vet student to clinical practice. Making the transition from student to practitioner can be a challenging time for many new graduates and at Nottingham we are currently looking at ways in which we can facilitate this transition. We have surveyed final year students and new graduates to gain a more in depth understanding of their perceptions of the requirements for practice. We are now looking for the opinions of employers of new graduates to understand in more detail what employers look for and to what extent this is aligned with students' perceptions.

We are looking for participants who currently employ or have previously employed a new graduate veterinary surgeon to complete a questionnaire, which can be completed online at the following link:

https://www.surveymonkey.com/s/96KRY6T

Alternatively, a hard copy is attached to this email which can be printed and returned to the following address:

Kate Cobb,

School of Veterinary Medicine and Science

The University of Nottingham,

Sutton Bonington Campus,

Loughborough

Le12 5RD

The questionnaire consists of 11 questions and should take no longer than 10 minutes to complete. All data collected will remain anonymous and used for educational research purposes. This study has been approved by the School of Veterinary Medicine and Science's ethics committee. Participation is entirely voluntary and by completing the survey you are consenting to take part.

Please don't hesitate to contact me by email or on 0115 9516477 should you require any further information on this study.